THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XLIII.—No. 4. Whole No. 628. | NEW YORK, MONDAY, AUGUST 17, 1885 | $3 PER ANNUM IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. JOS. R. THOMAS, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Published on the 2d and 16th of each month, at No. 42 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $3.50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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[OFFICIAL CIRCULAR.]

Semi-Annual Meeting of the New England Association of Gas Engineers.

BIRMINGHAM, CONN., Aug. 10, 1885.

The next semi-annual meeting of the Association will be held at Point of Pines, on Tuesday and Wednesday, the 25th and 26th of August. This place was selected after careful consideration of the merits of all the other places suggested, and it seemed to the committee, one of whom visited the spot, that Point of Pines presented more attractions and gave promise of more enjoyment than any other that was brought to their attention.

It is proposed to hold a short meeting at 12 o'clock, Tuesday; the afternoon and evening to be spent in an informal manner—talking, walking, sight-seeing, sailing, etc., according to individual tastes and preferences. Wednesday morning a sail will be taken in some boat to be furnished by the Association. The boat will return about one o'clock, and the banquet, which will terminate the meeting, will be given at two.

The hotel bill for each person, including banquet (without wine), will be $6. Deductions will be made from this sum for any portion of the entertainment which may be omitted.

It is hoped that the ladies who have so kindly favored us with their presence for several years past, and who have added so much to the enjoyment of the Semi-Annuals, will not forget us this year; and to their number it is hoped others may be added, so that the family of each member will have at least one lady representative at the coming meeting.

Any member desiring to invite any friend or friends not members of the Association will please notify the Secretary, and an invitation will be forwarded at once.

Will all the members who are intending to be present kindly notify the Secretary at once of that fact and the number they will bring with them, so that accommodations can be secured at the hotel and arrangements made for the banquet, boat, etc.?

Trains leave Boston for Point of Pines via. Eastern R. R., or Boston, Revere Beach and Lynn R. R., at short intervals.

M. S. GREENOUGH,
C. L. GEROULD,
C. H. NETTLETON, } Committee.

[OFFICIAL NOTICE.]

Iowa Gas Association.

BURLINGTON, IOWA, Aug. 8, 1885.

To the Fraternity of the State of Iowa:

You are hereby earnestly invited to meet together on the third Wednesday (16th) of September, next, to complete the organization of the Iowa Gas Association, to confer together upon matters of interest connected with the gas business in this State, and to promote a more intimate acquaintance and fraternal relationship than has heretofore existed among us.

The meeting will be organized at 10 o'clock A.M., at the Barret House, where provision has been made for the accommodation of all.

Please be good enough to indicate by letter, addressed to the undersigned at an early date, of the acceptance of this invitation.

R. SPENCER, President.

THE DEATH AND BURIAL OF A HERO.

The twenty-third day of July, 1885, will go down to history as marking the occasion of a most sorrowful event—the demise of our soldier-President. Ulysses S. Grant; and while we cannot wish, in view of his long-protracted and terrible sufferings, that another moment had been added to his great anguish, we also cannot but keenly feel the shock resulting from the reflection that our hero is no more. We write of the dead soldier and president as one who had saved his country and remember the way in which he served it best in his treatment of those who acknowledged their honorable defeat.

Did we need evidence of the feeling existing in the Southerners' hearts towards the nation's defender, could we find better than that afforded by their demeanor and action between the sorrowful days of July 23d and Aug. 8th, or by their united voice since? An emphatic "No!" must be the response. There is, then, one side of the gloomy picture that may be looked upon with a feeling akin to pleasure—our hero's life was not terminated until he had witnessed the blotting out of all sectional strife, and knew that the North and South were firmly reunited forever.

THE LOWE INCANDESCENT BURNER.

"Prof." Lowe and his wonderful "inventions" have occupied a large share of the attention of the gas engineers of the present day; and we must confess that the "Prof." and his adjuncts have not been altogether successful—at least it would so seem—in filling any appreciable measure of space, or of bestowing any decided amount of profit upon those who were venturesome enough to make purchases of patent rights, etc. From the foregoing we would not wish it to be inferred that the "Prof." himself, and his partners, have not been successful in heaping up quite a comfortable store of this world's goods—be the latter included under the different items of stocks, bonds, cash in bank, supplies on hand, or any other of the various well-known ledger headings of a really prosperous mercantile house. No; information and belief incline us to the idea that the "Prof." is "doing quite well" in this direction.

Of course, it is pretty well known at this time that the "Prof." professes to have made another great discovery in the application of "gas science;" and for some months past various journals, technical and otherwise, have published most glowing accounts as to how the "Prof." had solved the problem of an incandescent gas light. Heating gas, which could be made and sold at enormous profit when disposed of at the figure of 50 cents per thousand cubic feet, was hereafter to turn night into day when consumed through the medium of the "Lowe Incandescent Burner." The trouble about some of the gas men is that they are disposed to view the "Prof.'s" assertions with a certain amount of suspicion. Having heard him "profess" before, without beholding the fruit of the "professions" made practically manifest afterwards, it is but natural that doubters should be plentiful; and in the case of the incandescent burner these suspicions were not weakened when it was understood that a rather Keely-like air of mystery surrounded the details of the new invention. The material out of which the burner was constructed was "a secret known only to the inventor," etc. Now, all that sort of bosh may serve very well to satisfy holders of Keely motor stock; but holders of stock in gas companies, and in the habit of receiving dividends thereon, are not usually inclined to look with favor upon the proposed purchase of patent rights having only the initial merit (?) of mystery surrounding them, and that mystery put forward as one of the reasons why investigation should be made. We have received several communications from subscribers the writers of which seemed desirous that we should explain all about the Lowe incandescent light; but as we, at the time of their receipt, knew nothing at all about the subject, all such querists received the answer that when we were posted in the matter we would tell what we knew, and this promise we now propose to redeem.

The limits of Norristown, Pa., having become too small for the swelling importance of the new invention, the show quarters of the mysterious incandescent composition were removed to Lynn, Mass., where all the gas world was invited to pay a visit of inspection. Amongst the rest of the "ignorant" we were honored with the following:

"LOWE MANUFACTURING CO.,
LYNN, MASS., July 28, 1885.

"AMERICAN GAS LIGHT JOURNAL, New York City:

"Gentlemen:—We now have the "Lowe" incandescent system of gas lighting in active operation at our place, No. 23 Market street, this city, and knowing you to be interested in some branches of the gas science, extend to you an invitation to inspect same at your convenience.

"I to-day send you a Lynn *Transcript*, which contains a notice of our light.

Very truly, etc.,

"L. P. LOWE."

Of course, we were glad to understand that the Secretary of the Lowe Manufacturing Company had arrived at the point of "knowing" that we were "interested in some branches of the gas science," and thought him to be justified in making the assertion when we remembered that our apprenticeship had been served years before Mr. L. P. Lowe had been added to the world's population. The Lynn newspaper also came to hand; but we really could not make use of the article contained therein, as it closely resembled—not in typographical appearance, but in contents—a reading notice at "so much per line." A trip to Lynn, with the necessary period to be allotted to the investigation, would take up more of our time than we could possibly spare at the particular juncture, and so we were compelled to cast about for a representative. It was our good fortune to secure the services of one of the brightest, cleverest, and most impartial gas engineers of the East to act for us in making the investigation. His instructions were to act simply as though he were making the examination on his own account; and the result thereof is the following:

"The burner consists of a strip or loop of wire about one inch in diameter. Looped over the tip, and secured to the sides of the burner near the tip, is a helical coil, such as would be formed by winding a fine wire around a small lead pencil. The flame impinges upon both loop and coil, heating them to a point of incandescence rather under that of the ordinary incandescent electric light.

"The effect produced is that of a horseshoe-shaped band of light, one inch across the circle, and of about the width of a lead pencil. It is perfectly steady, and almost white in color. The gas issues from burner tip, at a pressure, probably, of two inches. As neither meters nor pressure gauges were visible, I was obliged to estimate the amount of gas being consumed. As it appeared to me, the rate of consumption was over four feet per hour.

"In my judgment, each burner afforded the light of ten candles. They were shown mostly in clusters; one window contained a cluster of 16, and another one of 8 burners. In the body of the store were two clusters of 8 and 10 burners respectively—the gas being heated by the products of combustion. The light from these clusters was fully utilized, being thrown down by porcelain reflectors. Over 50 burners were employed in the lighting of an ordinary narrow city store, with white walls. The lighting effect was fair; it was far from being brilliant.

"The composition of the wire is a mystery to outsiders, but it is spoken of as being practically indestructible by heat. Three things point to its being platinum—at least for the most part; I might indeed say, if not entirely. First, its color, which is a greyish-white; second, its cost, which is high; third, its power of lighting the gas when at low heat—a characteristic, of all the metals, alone possessed by platinum.

"The failure of Lewis's platinum burner, and the results of Edison's experiments on incandescent wire, do not augur well for the success of the Lowe burner. As a means of lighting, taken by itself, there seems to be little chance for its competing with gas as ordinarily supplied. We should work under the disadvantage of high pressure, and a delicate and costly burner, to save not over 25 cents in the cost of gas in holder—the expense of distribution, etc., being of course the same in each case.

"When combined with heating gas, and considering the possibility of distributing an enormous quantity for fuel purposes, by which expenses may be averaged down, possibly another face may be put upon the matter. However, inquiry among the customers of the Lynn fuel gas company demonstrates that heating gas is there almost universally considered a failure—its cost to consumers, even at a charge of fifty cents per thousand, is deemed too great by them. The business now being done there is much less than when the company started, and is still gradually decreasing. A canvass of Lynn, even in the limited period allowed, convinced me that the time for heating gas has not arrived; while without the support of heating gas the incandescent light stands a poor chance of permanent success."

Our readers may rest assured that we will return to this matter again.

The Market for Gas Securities.

The city market for gas securities remains dull, although the records show that strength marks the situation. Consolidated gas rules at previous figures, but the transactions have just about been frequent enough to make a quotation. In our item columns we note the fact that the Equitable stockholders have decided to increase the capital stock of company in the sum of one million dollars. The East New York (L. I.) Company management have also decided to issue a first mortgage of a quarter million.

Brooklyn shares are strong. Williamsburgh is up to 156–160, and higher prices are predicted. Peoples' gas is stronger, while the only delinquent in the Brooklyn list, in the matter of ruling quotations, is instanced in the case of Citizens Company. Metropolitan, of Brooklyn, would seem to be a purchase.

In out-of-town shares but little change is recorded, save in the case of Chicago gas. In spite of the queer proceedings recently transacted in the Lake City municipal circles (reference is here made to the Equitable "deal" now in progress there), the stock of the Chicago Company is held at advancing figures. For regular list see page 98.

[Official Report—Continued from page 65.]

Eighth Annual Meeting of the Western Gas Association.

Held at the Tremont House, Chicago, Ills., May 13, 14, and 15, 1885.

Second Day—Morning Session.

After a vote of thanks (on motion of Mr. Somerville) had been tendered Mr. Page for his paper on the Cooper Coal Liming Process, President Lansden advanced the hope that a spirited discussion on the topic treated of would ensue. He said the paper brought up points that might be new to some of the members present, although the technical journals had contained copious mention of the matter. He (the President) further remarked that if the statements made by Mr. Page would bear the test of practice, the Cooper process could not fail to be of great value and importance to the gas men of the United States, and more particularly to those residing in the Western section of the country.

Discussion.

Mr. Geo. G. Ramsdell—I listened attentively to Mr. Page, but I failed to obtain an accurate impression as to the first cost of this process. About how expensive is it?

Mr. Page—I think that this was clearly outlined in my paper. Mr. Ramsdell will find it stated therein that not only is there no additional plant required, but that actually the plant is diminished.

Mr. Ramsdell—I mean as to the cost of material.

Mr. Page—That question is covered by the statement which puts the additional cost of the lime used at £244, or $1,220. The value of the weight of lime found in the resultant coke, and sold as coke, is put at $700, or, so far as these items go, showing a difference in first cost of $520; but the saving in cost of purification is placed at £570—or a net saving over the old system of about £465—to which is also to be added the increased value of the greater weight of sulphate obtained (£282); making, in round numbers, £748 as the net profit returned in the course of twelve months' working at Tunbridge Wells, on the carbonization of 11,000 tons of coal. As Mr. Spice puts it, the net money value paid into the treasury amounted to 30 cents per ton of coal carbonized; or, in other words, as a consequence of introducing the Cooper process, the distillation of 11,000 tons of limed coal increased the Tunbridge Wells plant's receipts by the sum of $3,300, to make no mention of doing away with the foul lime nuisance.

Mr. Thomas Smith—Toward the end of the seventeen months in which those purifiers were used, was there no increase in sulphuretted hydrogen shown?

Mr. Page—In regard to that point Mr. Spice says that during the seventeen months' working the average test showed but 10.17 grains per 100 cubic feet of gas—the variation was but 2.05 grains up or down. At Tunbridge Wells they are making much purer gas than is being put out by the London companies. According to the official tables in Examiner's report, these latter average 16 grains per 100 cubic feet.

Mr. E. McMillin—Did not Mr. Page say that the sulphur compounds were reduced one-half in the crude gas, the reduction being due to the use of limed coal?

Mr. Page—I believe that is the statement.

Mr. McMillin—These purifiers have only had half the work to do that was exacted from them before, and of this result one-half is to be attributed to the liming process, while the other half is due to the percentage of air that is admitted?

Mr. Page—The introduction of the one per cent. of air is claimed to be an important feature.

Mr. McMillin—Should we introduce air, those of us who are now using oxide would come within fifty per cent. of accomplishing what they are doing?

Mr. Page—I cannot see how that is; but you will probably try the experiment.

Mr. McMillin—I certainly will.

Mr. Page—I might perhaps explain my position in regard to this matter. My interest in the subject arose on account of an intimate personal acquaintance with Mr. Spice, which was formed when I met him in London, and fostered since by correspondence. He had been in this country, and is known to many of our gas engineers. In my opinion this is one of the most important aids that have recently come to the front as an assistant to coal gas. I have gathered this data as a result of correspondence and a scanning of the English and American gas light journals, in connection with other scientific papers.

Mr. Somerville—I was extremely glad when I noticed Mr. Page's name down to read this paper, because I knew he would present something very interesting. I have not been disappointed. I feel just now like putting that process into my works. Certainly the facts are astonishing. There are one or two questions, though, that I would like to ask him. He spoke of the cost as being about 12 cents; does that sum include the royalty payments? I understand it is a patented process.

Mr. Page—I cannot answer that point.

Mr. Somerville—Mr. Page says that the lime was dampened with its own weight of water. The thought has just struck me—would not this be putting damp coal into the retorts? Still, there are the results. He mentioned also (and I noticed the distinction drawn) about the quality of the coke. Twice he drew attention to its value as a fuel for domestic purposes; still, it is well known that we have occasion to use the coke for other than domestic purposes. I would like to ask Mr. Page if there is any trouble in using that coke in our furnaces; does this lime cause any flux on the grate bars? Or why did he so carefully mention that it was good for domestic purposes? Is it not good also for use in our furnaces?

Mr. Page—The statement was made absolutely that there is no damage caused to settings or grate bars on account of fluxing. In domestic use the limed coke burns with a bright flame. It adds to the coke precisely that element needed to make it the very thing for use in open grates.

Mr. McMillin—I should think the limed coke would be objectionable for use in metallurgical operations, because of the fact that the sulphur, being contained as sulphate of lime, would not be vaporized. I take it for granted that Mr. Spice sells his coke by weight. The question whether coke should be sold by weight or by measure, formerly occupied a large portion of the time of our Association. That gentleman, I know, would advocate selling his coke by weight. Probably 60 pounds of lime would not add anything to the measure.

Mr. Page—I have found no reference in the technical journals to the use of limed coke in metallurgical operations. There need be no grave fears entertained on that head, however, since the coke of gas works is principally consumed in the household or in the retort house.

Mr. Somerville—Is it not also a fact that other English engineers have tried the Cooper process without securing a repetition or even an approach to the favorable results reported from Tunbridge Wells? And is it not the case that there is now a good deal of discussion going on there with regard to the subject?

Mr. Page—I believe I may say that no other subject brought up during the last two or three years at the meetings of the English Associations of Gas Engineers has met with like opposition. Only nine months ago the editor of the English *Journal of Gas Lighting* made light of the Cooper process; but in a more recent issue, or when the year's working at Tunbridge Wells was reported, he commented more favorably upon it. Geo. Stevenson attacked it; your good brother John Somerville reported adversely; and others of the most distinguished men among the gas engineers in Scotland opposed it. Still, they cannot attack results. If it is successfully worked on 11,000 tons of coal at Tunbridge Wells, why should it not succeed when applied to the 3,000,000 tons of London? So, at least, I would be inclined to reason on the matter. Now that gas engineers are beginning to favor it, and the technical journals are saying that it is looking like a success, I think we must admit that what Mr. R. P. Spice (whose record from beginning to end as a gas engineer has never been questioned) says with regard to this can be accepted as a fact. With respect to the failures reported Mr. Spice shows conclusively that these occurred simply because the experiments tried, although on quite a large scale, were not properly attended to—their details were not given the attention and care that a new process, and one so entirely different from the ordinary mode of working, would seem to demand.

Mr. E. J. King—Mr. Page—considering the increased yield of ammonia under the liming process—can you state what effect that yield will have on its price?

Mr. Page—Here you may appreciate another reason why I should have an important interest in this process—it enlarges the production of ammonia hitherto secured from a ton of coal. When you increase the quantity of ammonia gained from a ton of coal, you increase the income of every coal gas company. Ammonia is sure to become a more extensive article of commerce than is the case at present. Nitrate of soda cannot long be sold at $1\frac{7}{8}$ cents per pound (delivered) in the markets of London and New York. Even if sulphate continues at the figure of 3 cents per pound, with a 20 per cent. increase in the amount gained from a ton of coal secured, we see again that that which is lacking in the water gas process gives an important value to coal gas—viz., the residuals that are sneered at by the water gas promoters. But when, as has been shown in a recent American case, the residuals pay for the coal delivered in the gas company's house, the matter becomes important.

The President—I would like to know of that place where the gas man's residuals are sold for what his coal costs him. I would like to go there and make gas.

The Association here took a recess, with the understanding that business would be resumed at 2 P.M.

Afternoon Session.

The President convened the members at the appointed hour. Mr. E. McMillin called attention to the fact that the second article of the by-laws read as follows:

"Any person directly or indirectly connected with the management of gas works or gas machinery, or who may be skilled therein, shall be eligible for election as an honorary member of this Association." He offered the following as an amendment thereto:

"*Resolved*, That article II. of the by-laws be amended by striking out the word 'honorary' in the fourth line, and inserting in lieu thereof the word 'associate.'"

Mr. McMillin then went on to say—We now have about as many honorary as active members. That is rather an anomalous condition of affairs, where a body elects a gentleman to membership, requires him to pay dues, and yet affords him no privileges. There would seem to be little of honor conferred by the process. It is on this account that I offer the amendment.

The President—The amendment offered by Mr. McMillin covers the purpose originally intended. A mistake occurred in the printing of the by-laws by which the original intention was nullified. As I understand it, this amendment will lie over until the first day of our next regular meeting, at which time it will come up for final action.

Report of Committee Appointed to Name Place for Holding Next Annual Meeting.

Mr. R. Spencer, from Committee to Name Place of Next Meeting, reported that Columbus, Ohio, was recommended as the choice of those having the matter in hand. After some discussion the Association ratified the selection. As a Committee of Arrangements the President named Messrs. E. McMillin, of Columbus; Eugene Printz, of Zanesville; and Geo. H. Tayler, of Warren.

The President also appointed Messrs. James Somerville, J. B. Howard, and Z. T. F. Runner, as a Committee to prepare and present resolutions of thanks to the gentlemen who had made such elaborate preparations for the comfort of the members during their visit in Chicago.

Mr. Emerson McMillin, of Columbus, Ohio, then read the following paper on the subject of—

Natural Gas.*

After the publication in the *Ohio Mining Journal* (last August) of the very interesting and instructive paper by Dr. Orton, Chief Geologist of the Ohio Survey, it may naturally occur to you that now there is but slight call for another paper bearing upon the same subject. The question, however, is one of so much interest that it will bear frequent discussion; and while I shall present neither original ideas nor startling developments, I possibly may be able to present enough of fact, as ascertained by others, to make this paper of some value. As all those present may not have been fortunate enough to have seen Dr. Orton's article in print, I will cover, hurriedly at least, a portion of the ground discussed in his paper.

We are told that the Chinese have for hundreds of years utilized the natural gas issuing from the crevices of the earth's surface in some portions of the Flowery Kingdom, and that they now drill, in some instances, 3,000 feet deep to strike the gas veins. Perhaps the oldest historical instance of which we have a record of the discovery and use of natural gas is that of the Apollo Oracle, at Delphi, Greece. Natural gas was used there a thousand years before the Christian Era. It has been utilized in many portions of Europe and Asia for hundreds of years. There are traditions that the red man smoked his pipe in the lurid light of burning springs before the advent of the white man to the American Continent. It was used at a very early day in the Kanawha Valley for the evaporation of salt water. In a letter recently received from the proprietor of the gas works at Fredonia, N. Y., he tells me that the gas has been in use there for more than sixty years; that it is necessary to drill only from 100 to 300 feet in order to obtain it; that some fifteen wells, mostly of recent date, are in use; and that increasing the number of new wells did not appear to diminish the supply in any of the old ones. A gas well was struck in boring for salt at Olive, Noble County, Ohio, in 1814. Residences in Lorain County, Ohio, have been lighted for fifteen or twenty years with natural gas. At East Liverpool, Ohio, the gas has been flowing for more than twenty years. At New Cumberland, W. Va., the gas has been utilized for twenty-five years, and the supply is still good. In scores of other places, in this and other States, natural gas has been utilized for the past twenty-five or even fifty years. Yet apparently the interest has not been great or general in this question until recent times.

To enumerate all the places and locations where gas has been found would require a volume itself. The records in this respect are not so complete as are the records respecting oil geographical locations and geological horizons. I would assume, however, that wherever oil is found gas must almost of necessity be near. The following are a few of these locations and horizons: Oils and bitumen of the Pacific Slope, of Mexico, West Indies, and South America are tertiary; in California, miocene; and eocene in Trinidad. Nearly all far East productions may be, as far as known, accredited to the eocene epoch. The greatest part of the world's supply of petroleum comes from horizons in the rocks older than the carboniferous period, though the greatest number of localities and largest extent of oil bearing strata are of much more recent date, eocene rocks being the greatest reservoirs.

Gas has been found in quantities possessing economic value in or directly over the Utica shales of the lower silurian, as at Burkesville, Ky.; Collingwood, Canada; and in the lower gas veins of Findlay and Bowling Green, Ohio; in the Niagara shales of the upper silurian, as found in the upper gas veins at Findlay and Bowling Green; and in the Huron shales of the Devonian Age, as found in hundreds of places in Ohio, West Virginia, and at some points in Kentucky. In Pennsylvania the greatest gas horizon is in the Catskill rocks, while the greatest oil reservoir of Pennsylvania is in the Upper Chemung, 300 feet below the Catskill. That part of the Ohio shale designated the "Cleveland shale" is the gas and oil producer of Northern Ohio, along the lake region—as at Mecca, Grafton, etc. The gas and oil (some at least) of Washington County, Ohio, are obtained at the top of the lower coal measures; and even the lower oil rock of that locality, while being 300 or 400 feet below the first "sand" or oil rock, is still reported with a thin seam of coal a few feet above it. (See 2d Vol. Ohio Geological Survey, page 497.)

The territory in the United States in which we may expect, with some show of reason, to find gas, is quite large; and it has had its borders, so far as Ohio is concerned, materially extended during the past year. Western New York, Western Pennsylvania, Northeastern Ohio, much of West Virginia, limited parts of Kentucky and Indiana, are now producing gas. There is a *possibility* of finding it in any part of Ohio where the Huron shale exists with sufficient covering. The same remark probably applies to other States. It is said a good supply of gas is obtained in the neighborhood of Kansas City, at a depth of not over 300 feet. Harrison County, Indiana, seems to be a fairly good gas territory. The successful borings at Findlay and Bowling Green, Ohio, indicate that we may reasonably expect to find gas in the Trenton lime or Utica shales of the lower silurian, especially along the crest of the Cincinnati arch. The apparently favorable conditions for finding gas at this horizon extend across the western half of the State from north to south. The developments at Findlay are very encouraging, and are now sufficiently numerous to warrant predictions that success may reasonably be expected in a search for gas in the territory and at the horizon mentioned.

The southern part of our State possesses all the apparent requisites for finding gas in abundance in the Huron shale (aside from the absence of folds in the strata); and yet no wells put down in that territory have ever yielded gas in quantity to possess much if any economic value. A well drilled in the year 1865, at Rio Grande, Gallia County, starting at about the horizon, if I remember rightly, of the Upper Freeport coal, and going down 850 feet, struck gas which flowed for some years; and, for aught I know, is flowing yet. The quantity was not large, though this possibly might have been in a measure accounted for by the pressure of the water which flowed constantly from the salt rock up over the tubing. A well has been drilled during the past year by the Belfont Iron Works Company, at Ironton, Ohio. The well starts 160 feet below the horizon of the ferriferous limestone, and was driven more than 2,000 feet. But little gas, and no oil of consequence, was obtained. The parties ceased drilling when they could no longer keep out a vein of water struck at a depth of 2,000 feet, which water rose up some 800 feet in the hole, and emitted such a disagreeable odor that the workmen claimed they could no longer endure the smell, and so quit work. Just what stratum constitutes the bottom of the well is not quite clear. There were many indications that they were down into the Niagara, and the same indications would apply to the supposition that they were just through the corniferous and into the Helderberg. A sandstone was pierced, just before reaching the vein of water, saturated with sulphuretted hydrogen. Columbus is located on the horizon of the corniferous limestone, and by going down 90 feet and passing through a sand rock a vein of sulphur water, strongly impregnated with sulphuretted hydrogen, is struck, and the water flows to the surface in great quantities. To my mind the similarity is something more than a coincidence.

Some excitement prevails at Middleport, in Meigs County, at this date, over the finding of oil in that locality. A well put down for gas, across the river in West Virginia, failed to find oil or gas in quantity to possess much value.

The fact that the four gas wells at Findlay, and the three at Bowling Green, have developed new territory causes more than ordinary interest to attach to them. On page 366, 2d volume of Ohio Geology, is published an interesting letter from Dr. Carr, written in 1872, in which he says that his

* In the preparation of this paper I have received valuable suggestions from Col. T. P. Roberts, of Pittsburgh, Pa.; Prof. I. C. White, of West Virginia University; and Prof. Edward Orton, Chief Geologist of the Ohio Survey. I have drawn largely from the 10th Vol. of U. S. Census; the Petroleum Industry, prepared by Prof. Peckham, of Pensylvania; and from Newberry's Ohio Reports.

house had then been lighted for nine or ten years from a well sunk but seven feet below the surface. Afterwards a well was drilled 135 feet into limestone; but the drill getting fast, the enterprise was abandoned, though the flow of gas was stronger than from the shallow wells. Gas was struck in small quantities in other parts of the town. In digging sewers through the town gas is struck, very foul with sulphuretted hydrogen. In drilling the second deep well at Findlay three veins of gas were struck in the gray slate—the first at 527 feet, the second at 623, and the third at 640 feet below the surface. These shales I have assumed are in the upper silurian, and belong to the Niagara group. Another and lower vein was struck at a depth of 1,200 feet, and while drilling in limestone. I assume that this is in the lower silurian, and that the gas comes from the Utica shales, or more probably from the Trenton limestones.

Many regard a good flow of gas from a well located in the vicinity of a manufacturing town as equal in value, as an investment, to a first-class gold mine. A demand is readily created for the gas at prices which must pay enormous profits upon the money expended. Nevertheless if one company were paying all the losses and reaping all the profits, up to this date it is a question upon which side of its ledger the profit and loss balance would appear.

During the year ending May 30th, 1880, there were oil and gas wells drilled to the number of 3,696. Of this number 3,541 were drilled in Pennsylvania, the remaining 155 being located in Ohio and West Virginia. The total cost of these wells, as reported to the Census Bureau, was $9,149,907, or an average cost of $2,475 for each hole put down. It is very probable that, under the impetus given to the business by the utilization of natural gas, and the greatly increased demand therefor, many more holes were drilled during the year 1884. The outlay for that year doubtless exceeded $10,000,000. The total expense of putting down these wells is proportioned about as follows: Rigs, 15 per cent.; engines and boilers, 8 per cent.; drive pipes, 6 per cent.; casing, 8 per cent.; tubing, 11 per cent.; torpedoes, 10 per cent.; labor, 27 per cent. This leaves 15 per cent. for incidentals.

Col. T. P. Roberts, of Pittsburg, a gentleman who has given the subject much thought and investigation, estimates that there have been 50,000 wells drilled in Pennsylvania alone; that thousands and perhaps tens of thousands of these wells have been unproductive (failing to get oil in paying quantities, when oil was sought, and finding no gas when gas was desired) will not be questioned. Can this enormous expenditure be curtailed without interfering with or checking the development of the industry? Prof. I. C. White, of the University of West Virginia, a gentleman of much experience, and possessing rare scientific attainments in the field of geology, answers the question affirmatively.

The writer having understood that Prof. White was meeting with almost phenomenal success, both in accurately locating gas wells, and in condemning territory, asked him to give the readers of the Ohio *Mining Journal* the benefit of his knowledge and experience, to which request he kindly assented. Not having time to prepare an article for publication, he gave me the facts in a private letter, from which I shall quote liberally. He says:

"In 1883 I was engaged by Pittsburgh parties interested in natural gas to study up the question as to whether the presence or absence of gas could be determined by any geological features with a reasonable degree of certainty. In order to do this I visited the Murraysville, Tarentum, Butler, Washington, Wellsburg, and every other gas district that had been accidentally developed in drilling for oil. To my astonishment I found that every gas well in the region I was investigating was situated near or on the crown of a gentle uplift of the rocks, or on what we geologists term an anticlinal; while only a short distance (one-half to one mile) on either side, in the synclines, only salt water was found and no gas to amount to anything. For instance, the famous Murraysville well was exactly on the crest of the Pin-Hook anticlinal, of Stevenson's, Pennsylvania Report, 'K.' The Tarentum wells were near the line of the Bull Creek axis. The condition for the presence or absence of gas then seemed to resolve itself into one of structural geology. The tension of the arch of the anticline would, of course, in a loose, coarse, porous sand rock, open many fissures near the crest, and thus still further increase the capacity of the rock as a reservoir for gas, whether escaping upwards from beneath, or from the generation of gas within the rock itself, out of buried organic material. Of course, the reasons why the gas should seek the crown of the arch and the salt water be found in the trough, are self-evident from the nature of the two substances. Hence so far the theory and facts all agreed; but before practical men would take hold of the question the theory must be submitted to a practical test. To do this I traced the Murraysville arch southwestward to the Youghiogheny River, and located a test well on its crown more than ten miles from Murraysville, and where it was surrounded with water wells, one of which was one-fourth mile distant. Here certainly were the conditions for a satisfactory test. This well struck a large flow of gas (200 pounds pressure) in March of last year. On January 1st, 1884, I located gas territory for the Washington (Pa.) Heat and Light Company along the crest of the Washington anticlinal, and the three wells they have since put down on my locations have all been good, though a well located by other parties, and bored one mile off my line, got no gas, but a small flow of oil.

"As yet I have made no failures, though some wells are much more productive than others, apparently depending both on the strengh of the anticlinal and the thickness of the sand, or, in other words, the size of the reservoir."

The success in condemning territory by Prof. White has been quite as marked. He condemned the territory at Wheeling, Pittsburgh, Martin's Ferry, and other places; and in none of this condemned territory has subsequent drilling developed gas. Prof. White says the idea of finding gas at the crest of anticlinals was suggested to him by some one else.

Of course gas cannot always be found even where conditions appear to be favorable. The overlying material may not be porous enough to constitute a store-house, or fissures in the rock may permit the escape of the gas as generated; but Prof. White has certainly demonstrated that vast sums of money may be saved by intelligent investigation, and by the employment of persons with scientific knowledge—geologists—to make selections of locations for gas wells. As will be seen in another part of this paper, Dr. Newberry was governed ten years ago by the same rule in the location of oil wells. To my mind, however, the rule will not apply with the same probability of success to the location of oil as to the location of gas wells. Many writers mention the fact of the oils being located at the crest of the anticlinals. Prof. Minchell, in writing of the "oil break" of the volcano region of West Virginia, says: "Whether you strike gas, oil or water depends upon the comparative level of the point at which you strike the fissure." Dr. Orton says he has taught that idea to his classes for many years. Yet credit is due to Prof. White for making practical, thorough, and positive demonstration of the correctness of the theory, at least as applies to the location of gas wells.

It is generally conceded that natural gas, as well as petroleum, is generated from the carbonaceous material of the deeply-buried shales. There are many, however—whose opinions are worthy of consideration—who believe that the oil sands are the real producers, and still others who believe that the oil and gas come from the limestones. I think incontestable proof can be offered that all are right. I believe that the gases of the Devonian system come chiefly from the shales, but not exclusively. The corniferous lime at Chicago and Terre Haute are producers. Dr. T. Sterry Hunt estimates that the Chicago lime contains 7,750,000 barrels of petroleum to the square mile. The frequent occurrence of oil and bitumen found enclosed in geodes of limestone seems to establish the fact of its being indigenous.

The advocates of the idea that the sand rocks are not only the store-houses but the generators of the natural gases and oils have many facts to back up their theory; yet I am not sure that they have made out a clear case. To determine this point definitely it will be necessary to particularize a little more as to the real origin of the carbonaceous matter. What was it? Was it vegetable, similar to that which produced coal, or was it sea-weed débris? Or was it animal and not vegetable? Or was it both animal and vegetable? Or was it neither animal nor vegetable, but chemical? Instances may be cited in which an affirmative answer might be given to each of the inquiries. That the gases obtained from the Trenton, Niagara, and Corniferous limestones are animal admits no room for doubt in my mind. That the gases of the Utica shales, the Huron shales, and of the sandstones of the coal measures are partly animal and partly vegetable seems equally probable. That the gases of the volcanic regions are chemical may readily be believed. The writer has until recently supposed that Dr. Newberry (who was the first to suggest that the natural gases of Ohio and Pennsylvania were generated from the carbonaceous matter of the Huron shales) believed that the oils and gases were wholly of vegetable origin. A careful reading, however, of his second volume of "Ohio Geology" will show that he doubted that even at the date of that report (1874).

Speaking of the Cuyahoga shale, Dr. Newberry, in the 2d volume of the Ohio Survey, page 88, says it "is crowded with its characteristic mollusks, and with the bones, teeth, scales, and spines of fishes." The shale is described as dark gray or nearly black. On the same page he says, speaking of this same shale, that it is "literally made up of shells." On page 90, 2d volume, referring to the Berea grit, which is the oil sand of Grafton, Liverpool and Mecca, of Ohio, and the same rock is the oil sand of Oil Creek, Pa., he says, "it contains in large numbers the spine and teeth of fishes. Of these the most conspicuous are spines of a species of Ctenacanthus, of which more than *two dozen* were found upon a surface not larger than a square yard." Hundreds of quotations could be made from Newberry's Ohio Reports that would in a measure sustain the theory that the oils and gases were largely from animal matter; and many of these quotations would sustain the argument that at least some of the sandstones were producers as well as store-houses. In a paper read in February, 1882, Dr. Newberry says that the oils of the Niagara limestone are indigenous in that rock, and believes they are of animal origin. In this same paper he says the gases of the Hamilton shales are from the carbonaceous matter, apparently produced

from the decomposition of sea-weeds, these being abundant, and nearly all other fossils absent.

Very many eminent authorities may be quoted in maintenance of the claim that the natural oils and gases of some horizons at least are of animal origin. Peckham says Ohio and Pennsylvania oils are undoubtedly of vegetable origin; but thinks the Kentucky oils from the Trenton limestone are of animal origin. This statement was made, however, before the development of the new gas and oil field of Northwestern Ohio. Prof. T. Sterry Hunt attributes the origin to animal matter. There are others who reason that it is possible that they are neither of animal nor vegetable, but that the origin is purely chemical—that is, the result of chemical action upon inorganic matter. Byasson, of France, by experiment in 1871, produced petroleum from water and carbonic acid in contact with white-hot iron. A possible theory is suggested that sea water invades greatly heated portions of the earth, and comes into contact with unoxidized, highly heated metals. Berthelot, in 1866, suggested nearly the same theory, viz., the formation of acetylene by contact of carbonic acid with alkaline metals in the bowels of the earth, and then, through action of steam, carbides of hydrogen are formed. M. Mendeljeff, of Russia, in 1877, suggested that the law of gravity must put metals nearest the center of the earth. Water has reached the metallic carbides through crevices, and carburetted hydrogen is formed. In 1877 Mr. Cloez obtained oil by action of sulphuric acid on speigel-eisen.

It seems evident to me that gases are found in rocks to which they are indigenous, and in rocks where they have only been stored; that they are of animal, vegetable, and chemical origin; that the oils and gases of the older rocks are almost exclusively of animal origin; that the oils and gases of the shales are animal and vegetable—those of Devonian age in Ohio and Pennsylvania mostly vegetable; that the gases of the volcanic regions, issuing from the fumaroles, mostly chemical, with probably an intermingling of atmospheric gases or air, drawn into the earth by the chimney-like action of the volcanoes and of the fumaroles. That the oils of Ohio and Pennsylvania are not wholly derived from vegetable matter may be easily believed, when attention is called to the fact that the products of destructive distillation of coal have but few things in common with the products of oil distillation. Gas works that make gas from oil do not get a coal tar residual. I believe that neither alizarine nor anthracene, nor, in fact, any of the coloring matters of coal tar, are produced in the manufacture of oil gas. I am also under the impression that carbolic acid and cresylic acid are not found in the condensed liquids of oil gas. Little or no ammonia is produced. The heavy hydrocarbons belong to different series, and are in greater abundance. The percentage of free hydrogen is much less in oil than in coal gas. The advocates of the theory of vegetable origin may truthfully claim, however, that the valuable coloring matter obtained in the distillation of coal comes from the *coal tar;* that in the manufacture of oil gas the oil is really undergoing a second distillation; that the tar was left in the earth, and that the difference in quantity of ammonia present may be due to the modes of distillation. Pelouze, of France, obtained the same series of hydrocarbons from lime soap, made from fish oil, that are found in petroleum.

The distillation of the oils and gases from the fossils of the shales and limestones is a question that has not been so much discussed. The question is one that may be regarded by some as having no practical interest; and yet I am persuaded that if we had a more thorough knowledge of all these matters we would doubtless be able to reap some practical benefit from it. The temperature of the earth has been the principal factor in the distillation of the fossils. The pressure of the over-lying strata has probably been a prominent feature in the production of the oils. Could we ascertain the exact condition of the compounds when in the earth before the drill releases the pressure, it might assist us to guess what brings about liquefaction and gasification. It is the opinion of many that the natural gases of Pennsylvania exist in the earth as either solids or liquids, and that gasification occurs when the pressure is removed by the drill. Much may be said in support of this opinion, and something against it. If the gas was originally driven off from the fossils as marsh gas, does sufficient pressure exist in any of the gas wells, and especially the more shallow ones, to liquefy that gas? If the gas is compressed or distilled as an oil from the mass of fossiliferous material, and remains a liquid until the drill releases the pressure, would the gas go off so uniformly as marsh gas, or would there be vaporized the benzine series of carbon compounds, and the gases not be so permanent? It is easy to ask, but not to answer.

Dr. Newberry evidently believes that the distillation of the carbonaceous matter results in the direct production of gas, and that the liquid is produced by the condensation of the gases in the crevices of the overlying strata, as he uniformly advised searches for oil to be made at the crest of the anticlines. He says, in Vol. 2, page 504, "Ohio Geology," that the correctness of his ideas as to the proper place to drill for oil had been abundantly verified in practice. Had this statement been made by a less eminent authority I would have believed he was mistaken. Whether the gas is given off originally from solid matter, or escapes from the volatilization of the oil, in either event it will seek the highest point, and will occupy the interstices at the crest of the anticlines; and, if in abundance, must crowd the oil to a lower level. To bore for and obtain oil at the top of the fold would, in my opinion, be to invite the expense of a pumping well (by letting the gases escape), while to drill to one side of the fold would be to utilize the pressure and tension of the gases in forcing the oil to the surface. The Pennsylvania oils are not found at the crest of anticlines, but the gases are.

To my mind the distillate of the shales was mostly a liquid; that the gases were vaporized by the long continued warmth of the earth; that the marsh gas naturally sought the highest store-house, and was constantly leaving behind the richer hydrocarbons that were no longer able to maintain a gaseous state after the lighter gas had escaped from them; and that this accounts, in a large measure, for the great variation in the illuminating power of the gases from different wells—the almost pure CH_4 being found furthest from, while the richest and best gas is found in close proximity to the oil; that by constant distillation and condensation new oil and gas "sands" are being created. The gases are doubtless becoming poorer in carbon as the pressure increases by reason of the condensation of the compounds richest in heavy hydrocarbons.

It seems hard to believe that marsh gas exists in the earth either as a solid or liquid, and yet it must of necessity be greatly reduced in bulk. By the law of the compression of gases the bulk of marsh gas that measures 1,000 feet at atmospheric pressure must have been reduced to only about 70 feet when under 200 pounds pressure in the fissures and pores of the sand rocks, and estimates of pressure many times greater are common. The idea that the gas exists as a liquid or solid is borne out, in some instances, by the great reduction of temperature resulting from the escape of gas from some of the Pennsylvania wells. A cold so intense is sometimes produced that solidification occurs of everything in the vicinity whence the gas escapes, so that in one instance, at least, a hundred feet of ice had to be drilled through to again open up a frozen well.

The chemical feature of the natural gas question is one of great interest and importance. The composition of gases from different wells varies greatly, and, as before suggested, their composition, so far as the absence or presence of illuminants is concerned, is governed by the immediate presence or absence of oil. For other features of distinction, however, we cannot so easily account. The following table gives the analyses from a number of wells in different sections of the country, chiefly, however, from wells in Pennsylvania. The figures are taken from the report of a Committee of the Engineers' Society of Western Pennsylvania, excepting only Nos. 10 and 11 (Findlay wells.)

Composition of Gas from Various Wells in Different Sections of the Country.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	No. 11.
Hydrogen	.....	.....	6.10	13.50	22.50	19.50	.....	.....	.....	.....	.....
Marsh gas	82.41	96.50	75.44	80.11	60.27	78.24	.....	47.37	93.09	96.49	85.690
Ethane	.....	.....	18.12	5.72	6.80	.....	.....	.....	.....	.....	.....
Carbonic acid	10.11	.....	0.34	0.66	2.28	.....	15.86	3.10	2.18	0.88	0.150
Carbonic oxide	.....	0.50	.....	.....	.....	.....	.....	.....	.....	1.00	0.375
Nitrogen	4.31	.....	.....	.....	7.32	.....	.....	49.39	0.49	.....	10.260
Oxygen	0 23	2.00	.....	.....	0.83	2.20	.....	0.17	.....	.....	2.700
Illuminating hydrocarbons	2.94	1.00	.....	.....	.....	.....	.....	.....	3 26	0.50	.....
Sulphuretted hydrogen	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.88	0.365
Carbon bisulphide	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.25	0.110

Copies of numerous other analyses might be given, but the above table is sufficiently extensive to give a fair idea of the various qualities of natural gas. These analyses would furnish a theme for a long discussion. Marsh gas largely predominates in all, with one exception, that of No. 8, and this was gas from marsh ground. In this the quantity of nitrogen exceeds 49 per cent.; and yet there is shown but 0.17 per cent. of oxygen, which is positive proof that the large per cent. of nitrogen was not due to an admixture of air. Whence came it? It will not do to assume that it is only air robbed of its oxygen, as upon that hypothesis there should be 14 per cent. of oxygen present in other combinations, while there is but 2.25 per cent. present in combination with carbon as carbonic acid. No. 7 was from Rogers' Gulch, Wirt County, W. Virginia. By reason of the very large per cent. of carbonic acid in that gas it would be worthless as an illuminant, and its calorific value would also be low as compared with most of the other samples. No. 1, from West Bloomfield, N. Y., shows more than 10 per cent. of carbonic acid. This carbonic acid gas probably comes from the partial calcination of the carbonates of lime and magnesia, or from the oxidation of the carbonates of the protoxide of iron.

The sulphur compounds are shown in but two samples, Nos. 10 and 11. While the per cent. of sulphuretted hydrogen is inconveniently large (especially in No. 10), still its presence adds an element of safety to the use of the gases, and possibly imparts to them a value that none of the other samples possess.

It seems probable that the gases that shall hereafter be found, in our State at least, at the horizon of the Findlay and Bowling Green wells, will contain sulphuretted hydrogen. The very strong odor from the Ironton well on the Ohio River, the artesian wells at Columbus, flowing water strongly impregnated with sulphuretted hydrogen, the sulphur springs of Delaware, and the gas wells at Findlay and Bowling Green complete the chain across the State, all in about the same strata, and all giving off sulphuretted hydrogen. When going still lower down into the lower silurian as developed by artesian wells at Cincinnati, the sulphur is still found strongly impregnating the water.

The following shows the composition of natural gas from Lago di Naftia, in the Val del Bove, of Etna:

	No. 1.	No. 2.
Carbonic acid	94.20	84.58
Sulphuretted hydrogen	——	6.17
Nitrogen	1.82	2.42
Oxygen	0.28	4.52
Loss	3.70	2.31

Gas evolved from the fumaroles on the Island of Saint Paul (temperature 78 to 80° F.) shows the following composition:

Carbonic acid	14.24	Absolutely non-combustible.
Oxygen	17.01	
Nitrogen	68.75	

The presence of free oxygen and nitrogen in this gas, as also the proportions in which they are present, indicates to my mind that these gases are the result of air being drawn in by some unobserved means. A portion of the oxygen so drawn in has united with carbonaceous matter to increase the per cent. of carbonic acid. The natural gas from Campi Flegri, Vesuvius, is found to be mainly carbonic oxide; sometimes as high as 5 per cent. of sulphuretted hydrogen is present. The gas is changeable in its composition, at times containing as high as 50 to 60 per cent. of nitrogen. Nearly all of the gases of the volcanic regions are composed of carbonic acid, carbonic oxide, sulphuretted hydrogen and nitrogen. None possess hydrocarbon compounds in large quantities. This possibly may be the natural result of the free admission of air, and the conversion of hydrocarbons to carbonic oxide, carbonic acid, and water.

The pressure of the natural gas in the ground occasionally reaches a high figure—in some instances, in the wells of Pennsylvania, to that of more than thirty atmospheres. Prof. Peckham says it is even estimated at as high as 2,000 to 4,000 pounds per square inch. This, however, is with the pipes closed. With a free escape the pressure, of course, is greatly reduced. The Committee of Engineers' Report, before referred to, says that in no instance was the pressure found (in respect of the wells examined) to be more than two pounds per square inch with the pipe full open. That report was made a year ago. The Chairman of that Committee now writes me that there are authenticated instances of 25 pounds pressure at some wells. He describes the noise of the gas escaping from the Westinghouse well near Pittsburgh as exceeding that made by fifty locomotives blowing off steam. The temperature of the gases as they escape from the well is usually about 42° to 45° F.

One question of paramount interest is, will these wells continue to flow; and will the supply be equal to that of our subterranean coal stores? Sufficient data have not yet been furnished upon which to even base a good guess. The experience at Fredonia would lead us to expect the supply to last a long time. On the other hand, the experience in Pennsylvania tends to show that there is a "gradual diminution" of the flow from a well, "tending ultimately to total extinction."

The following historical facts, in regard to wells drilled by Spang, Chalfant & Co., are of interest in this connection:

"No. 1 has been in use nine years, and is still a good well; No. 2, four years in use, still flowing, though with diminished force. Its location is three miles distant from any other gas belt; No. 3, yield insignificant; No. 4, pressure diminished from 1½ pounds to zero in one week; No. 5, failed after four years' use; No. 6, in use six years, gradually failing; No. 7, failed after five years' use; No. 8, good yet; drilled in 1883; No. 9, dry hole; No. 10 was a small well; No. 11, good well. Gas struck within the past few days." These wells are in Butler County, Pa.

It is claimed (why the claim is made I do not know) that the average life of a Pennsylvania well is about 11 years. However, recent investigation presents this question in a more favorable light. It has been discovered that some wells, which had been considered as exhausted, were only obstructed by paraffine deposits, and that when the obstruction was removed the gas again flowed in paying quantities. It is not only possible but altogether probable that many of the abandoned wells may be obstructed with paraffine deposit; also with lime, magnesia, and common salt.

Some interesting experiments were made by the Committee, from whose report I have quoted so freely, in connection with the velocity of the gas and pressure in the pipes. A well giving 3½ oz. pressure, with a free escape, gave 15 lbs. pressure when connected to 16,000 feet of pipe; and it took the gas 4½ minutes to travel the length of the pipe. Gas with 90 lbs. initial pressure occupied 2¼ minutes in traversing 16,000 feet of pipe. Gas from a well having a pressure of 20 oz. had a velocity of 23,400 feet per minute; a rubber ball was driven through three miles of 5⅝ casing pipe in 2½ minutes. The great variations in velocities here recorded are doubtless due to the different sizes of conductors, and perhaps to angles and bends in the conduits.

The great problem for solution now seems to be, "How can the natural gases be transported economically and safely to consumers?" The most intense excitement has prevailed in and about Pittsburgh at times during the past winter, growing out of the accidents that have occurred through the defective system of transporting natural gases. The escape of the gases, which there possess no odor, caused houses to be blown up and many persons to be injured; in some instances human life was lost. The danger became so great that the matter was taken into court, and an effort made to correct the evil. In the equity proceedings between the "City of Pittsburgh *vs.* the Fuel Gas Company *et al.*," the Court appointed a commission of five intelligent persons, skilled in the various branches of science and mechanics, to make a thorough and exhaustive investigation of the questions involved. Occasionally the testimony given before this commission has been made public. The full report is expected to be given to the public soon, and it will doubtless impart to the word much valuable information. The parties giving testimony were experts—engineers, pipe layers, chemists, and mechanics; and the testimony given has been of the most confusing and conflicting character. While there are many questions of detail to be settled by the investigation, there are two questions to be determined that transcend all others. First, how high a pressure can be carried in the pipes without endangering life and property; and, second, to how low a pressure may the gas be reduced without increasing its cost beyond the point where a profit commensurate with the risk of the business can be made on the money invested.

It is now estimated that about 60,000,000 feet of natural gas is being used in Pittsburgh every twenty-four hours. This equals 2,500,000 feet every hour. The consumption, however, will not be regular, and the capacity of the supply pipes must be equal to a maximum delivery of 5,000,000 feet per hour.

The testimony before the commission, so far as it has been made public, indicates that experts are inclined to believe that the old-established practice of companies supplying manufactured gas ought to be taken as the rule, guide, and government of the natural gas companies. Should this rule be accepted, and assuming that the 5,000,000 feet is now being delivered at an average of 40 lbs. pressure, the present capacity of the mains would have to be increased about 16 times in order to supply the desired quantity at the maximum night pressure of the old gas companies, and would needs be increased about 32 times to supply the gas at the average day pressure carried in the pipes of the companies supplying illuminating gas. This would so enormously increase the cost and consequent capital employed as to greatly curtail its use in competition with the cheap and good coal of Pittsburgh. Experience, however, has demonstrated that the best results in combustion are obtained with the consumption of the gas at a pressure that does not exceed 3 oz. per square inch.

One gentleman gave testimony before the court commission, who claims to have submitted a report to the city of Chicago, showing that two parallel

pipes, 7 feet in diameter, would convey gas enough, *at an initial pressure of 4 oz. per square inch*—from the Murraysville well above Pittsburgh to the city of Chicago, Ills., so that when the gas was sold at only one cent per 1,000 feet it would give a revenue sufficient to pay interest on a capital of $35,000,000. It was proposed, however, to have intermediate storage points, and, I presume, to use exhausters. The rate of interest not being stated, we cannot accurately calculate the quantity of gas to be delivered; but, assuming the rate to be 4½ per cent. per annum, the daily interest would be more than $4,000, and to equal this sum 400,000,000 feet must be sold every 24 hours of the year. We cannot imagine how it could take less than one-fourth of a cent per 1,000 feet to send this gas from Pennsylvania to Chicago, distribute it to consumers, do the office work, make collections, and pay the necessary expenses incident to the maintenance of an organization employing a capital of $35,000,000; and if this estimate is not too high an additional 200,000,000 per day must be sold; or a total of 600,000,000 feet per day must be sent a distance of several hundred miles through two pipes each 7 feet in diameter. To the average gas man the scheme does not present a feasible aspect, neither in its practical working nor in its probable ultimate financial success.

The pipes that have heretofore been laid for transporting natural gas in and about Pittsburgh have not been laid much, if any, below a depth of 3 feet. The past winter was one of unusually low temperature, and the result was constant disturbance of the pipes by frost, with resulting enormous leakage and frightful destruction of property and life. The apparent absolute necessity for a better and safer system for transporting this dangerous vapor set inventors to work, and scores of plans and devices have been suggested; but, unfortunately, so far none of these seem equal to meet all phases of the demand. Some governors of great value have been invented; they control the pressure of the gas, preventing its rising above the desired point in the pipes, and if from any cause the gas flow ceases, causing extinguishment of fires or lights, the gas cannot again pass into the premises without being turned on by hand. This is probably the most useful invention yet brought out in connection with the natural gas question.

To prevent leaking at joints, innumerable plans have been suggested. The wrought pipes have been faced, and the threads made long enough so that the pipes can be butted together in the middle of the socket, practically making a good joint. Another plan was to chamfer the ends of the pipes, and screw them in against a gasket of lead in the center of the socket. Either of these plans would doubtless have given a good joint had the temperature of the pipe always remained the same as when put down; but, owing to the shallow depths at which the conduits were laid, the joints were failures. Screw joints, caulked with copper wire, also failed for the same reason. Had these joints been made with the pipe at about 42° temperature, and the mains buried 7 or 8 feet in the earth, it is my opinion that they would have been practically tight, even at 100 lbs. pressure. Pipe should not be laid in long, straight sections, but should form, when down, a slightly wavy line, to afford room for contraction without destruction of joints. Much of the trouble from leaky joints has been attributed to pressure variation. The register sheets show a constantly varying pressure, the variations generally being slight; but occasionally a drop of 5 lbs. will be noted, followed by a sudden leap to 90 or 100 lbs. per square inch. Now I do not believe that, with screw joints, this change of pressure causes undue leakage. The increased pressure must give an increase of temperature, and that in turn must cause expansion of the pipes, and a consequent tightening of the joints.

It has been suggested that all high pressure pipes should be brought into Pittsburgh overhead, when the leaking gas would be diffused in the atmosphere. That possibly might prevent accident—though I doubt it; and it would greatly add to the quantity of gas lost by leakage, as a result of constant change in temperature. One company has laid some lines of pipe at the usual depth in the ground, then placed a clay pipe along top of this pipe, with an occasional outlet leading to and up through a lamp post, where a light is kept constantly burning—the idea being to cause the gas escaping from the iron supply main to follow along in the clay pipe, and then escape to burner tip in lamp post, there to be consumed. This, of course, does not prevent leakage, but prevents accidents from such escapes. Opinions differ as to whether this plan will prove successful, the weight of opinion seeming to be against it. Another plan, suggested by Col. Roberts, is that of laying the main below frost, then putting a sleeve over each joint of the main; this sleeve to be tapped for, say, a ¾-inch pipe, and this pipe to be attached to a 2-inch pipe running parallel to and lying over the main pipe, the upper pipe being buried just under the street pavement. The gas leaking from the joint would enter the sleeve surrounding it, pass up the small pipe into the 2-inch, which pipe shall have stopcocks or valves between the joints, and by the aid of these valves the leaky joint can be located with but little trouble and little disturbance to the street.

The objects sought to be accomplished are—first, to prevent the escape of gas into cellars; and, second, to be able to locate the leaks with rapidity and certainty, and with the minimum disturbance to the surface of the streets. Owing to the difference in the composition of the gases, that found in the vicinity of Pittsburgh is much more difficult to transport without leakage than is that of the oil regions. In the first place, its specific gravity is much less; second, there is an absence of the oily residuals, which aid in closing up the small interstices of the pipes and joints. The specific gravity of the Pittsburgh gas is given as 0.557, and that of Bradford as 0.850, air being 1.

Many strange ideas have been given out through the court investigation at Pittsburgh. It is said that chemists differ greatly respecting the characteristics of natural gas. It is possible, however, that some are classed as chemits by the newspapers who do not class themselves as such; and perhaps some style themselves chemists who would not be given that rating by competent judges. One of the claims set forth by a "chemist" was that natural gas has a great affinity for water, and that it seeks low levels in consequence; hence the penetration of gas to the cellars of buildings. One claims the absence of salt water, and another finds it in abundance. One says the gas has a strong odor, and another says it has no odor. To my mind the gas may or may not carry a strong odor, depending, first, upon the locality from which it comes; and, second, the distance and velocity of travel. If the gas is permitted to become motionless, it will doubtless drop the salt water and the solid particles or condensable vapors that impart odor to the gas from some wells.

The uses to which natural gas can be put are numerous. It can be used for any purpose for which coal is or can be used, with perhaps the exception of smelting iron ores; and it fails in this respect through no inherent defect, but for want of proper apparatus. It is used for puddling and heating iron, melting steel, raising steam, for melting crude material in glass works and for annealing glass, for domestic heating and cooking, and in lighting residences, offices, and factories. For the latter purpose it is not well adapted, especially when the gas does not flow from the vicinity of oil pools. It is said that a light of 24 candles may be obtained from the gas at Bradford, Pa., by the use of Argand burners; but not more than 8 or ten candles can be obtained by the use of open burners. This looks much as though the intensity of light depended upon the intensity of temperature. I have before suggested that an admixture of water gas, CO, and H would probably add to the illuminating power of natural gas, especially when consumed in an open burner. The Bradford gas contains a large percentage of heavy hydrocarbons; gases in other sections contain but little.

In a series of practical experiments made at Pittsburgh it was found that one pound of the natural gas (23.5 feet) would evaporate 20.31 pounds of water; or, in practice, it gave 83.40 per cent. of its theoretical value. On the other hand, the best Youghiogheny coal, under the same boiler, and with similar conditions, evaporated nine pounds of water, giving only 60.90 per cent. of its theoretical value. The result shows that 1,000 feet of natural gas will do about 25 per cent more work, in practice, than one bushel of the best Youghiogheny coal. If there were no other advantages, such as perfect control of temperature, absence of ashes and clinker, saving of stokers' wages, cost of hauling coal, etc., gas would have to be sold at a very low figure to compete with coal. The price now charged in Pittsburgh varies from 12 to 20 cents per 1,000 feet. One concern in Pittsburgh more than one year ago was paying $8,000 per month for gas. The natural gas interest is yet in its infancy, and I predict for it rapid growth in the near future.

To the listeners who have followed me through this long and disconnected dissertation I can offer a little comfort and possible compensation by informing them of the fact that, barring accidents, Dr. Edward Orton will issue another (or supplemental) volume of economic geology during this year, in which this question will be given a very prominent place. His volume will be the latest, and unquestionably the best, publication on the subject of natural gas.

[To be continued.]

[Certified Copy.]

Text of the Bill Creating a Board of Gas Commissioners for the State of Massachusetts.

[The following are the terms of the Act creating a Board of Gas Commissioners for the State of Massachusetts. The measure was approved on June 11, 1885; and the Governor, on July 16 last, appointed the gentlemen who are to serve on the Board. For the names of the Commissioners see Journal, date of August 3, p. 69, second column.]

Commonwealth of Massachusetts.

In the year One Thousand Eight Hundred and Eighty-five.

An Act to Establish a Board of Gas Commissioners.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:

Section 1. The governor, by and with the consent of the council, shall appoint three citizens of this Commonwealth, who shall constitute a board of gas commissioners, and the governor shall designate the chairman thereof.

Said board shall have a clerk, to be appointed by the governor, with the consent of the council, who shall keep a full and faithful record of its proceedings, and shall serve such notices and perform such other duties as the commissioners may require, and shall be sworn before entering upon the discharge of his duties.

Sect. 2. One of said commissioners shall be appointed for one year, one for two years, and one for three years from the first day of July, eighteen hundred and eighty-five; and annually thereafter the governor shall appoint, as hereinbefore provided, one commissioner to serve for three years from the first day of July in the year of his appointment and until his successor is appointed and qualified. If a vacancy occurs, by resignation or otherwise, the governor shall in like manner appoint a commissioner for the residue of the term, and may, with the consent of the council, remove any commissioner for cause, after notice and hearing.

Sect. 3. Said commissioners shall be sworn to the faithful performance of the duties of their respective offices before entering upon the discharge of the same; shall not be in the employ of or own any stock in any gas company, or be in any way, directly or indirectly, interested pecuniarialy in the manufacture or sale of gas, or any article or commodity used by gas companies, or used for any purpose connected with the manufacture or sale of gas.

Sect. 4. The annual salary of the chairman of the board shall be three thousand dollars, and that of the other commissioners two thousand five hundred dollars each, to be paid monthly from the treasury of the Commonwealth. The commissioners shall be provided with an office in the state house, or in some other suitable place in the city of Boston, in which their records shall be kept.

Sect. 5. The board may expend a sum not exceeding one thousand dollars annually in procuring necessary books, statistics, and stationery, and in defraying expenses incidental and necessary to the discharge of their duties; and a sum not exceeding two thousand dollars annually, in defraying the compensation and expenses of their clerk, payable monthly from the treasury of the Commonwealth.

Sect. 6. The annual expenses of the commissioners and clerk, including salaries, shall be borne by the several gas companies in proportion to their gross earnings, and shall be assessed and recovered in the manner provided for the assessment and recovery of the expenses of the railroad commissioners.

Sect. 7. Every gas company shall annually make a return to said board in a form and at a time prescribed by said board, setting forth the amount of its authorized capital, its indebtedness and financial condition on the first day of January preceding, and a statement of its income and expenses during the preceding year, together with its dividends paid or declared, and a list containing the names of all its salaried officers, and the amount of annual salary paid to each; and said return shall be signed and sworn to by the president and treasurer of said company and a majority of its directors. Every such company shall also, at all times, on request, furnish any statement of information required by the board concerning the condition, management, and operations of the company, and shall comply with all lawful orders of said board.

Sect. 8. Said board shall have the general supervision of all corporations engaged in the manufacture and sale of gas for lighting and for fuel, and shall make all necessary examinations and inquiries, and keep themselves informed as to the compliance of the several corporations with the provisions of law.

Sect. 9. Upon the complaint, in writing, of the mayor of a city, or the selectmen of a town in which a gas company is located, or of twenty customers of such company, either of the quality or price of the gas sold and delivered by such company, the board shall notify the company of such complaint by leaving at their office a copy thereof, and shall thereupon, after notice, give a public hearing to such petitioner and such company, and after said hearing may order, if they deem just and proper, any reduction in the price of gas or improvement in quality thereof, and they shall pass such orders and take such action as are necessary thereto, and a report of the proceedings and the result thereof shall be included in their annual report to the legislature.

Sect. 10. In any city or town in which a gas company exists in active operation, no other gas company, nor any other persons, shall dig up and open the streets, lanes, and highways of such city or town, for the purpose of laying gas pipes therein, without the consent of the mayor and aldermen or selectmen of such city or town, after a public hearing before said mayor and aldermen or selectmen and notice to all parties interested, by publication or otherwise.

Sect. 11. The board shall, from time to time, ascertain with what degree of purity the gas companies can reasonably be required to make and supply gas; and if any change in the existing laws requiring purity in gas shall be, in their opinion, desirable or expedient, they shall so report to the legislature in their next report.

Sect. 12. The board, whenever any such company violates or neglects in any respect to comply with the provisions of any law, or refuses or neglects to comply with any lawful order of the board, shall give notice thereof, in writing, to such corporation and to the attorney-general, who shall take such proceedings thereon as he may deem expedient.

Sect. 13. Any court having jurisdiction in equity, in term time or vacation, may, on the application of said board, by any suitable process or decree in equity, enforce the provisions of this act and the lawful orders of said board.

Sect. 14. The board shall make an annual report of its doings to the legislature in January, with such suggestions as to the condition of affairs or conduct of the gas companies as may be deemed appropriate.

Sect. 15. Nothing in this act shall affect the office of gas inspector as constituted by chapter sixty-one of the Public Statutes, excepting that said inspector shall, whenever requested by the board, give to them such information and assistance as they may require, consistent with the duties of his office.

Sect. 16. Any gas company which, or any person who, is aggrieved by the decision of the mayor and aldermen or selectmen of a city or town under the provisions of the tenth section of this act may appeal therefrom to said board within thirty days from the notice of said decision, and said board shall thereupon give due notice and hear all the parties in interest, and its decision thereupon shall be final.

Sect. 17. This act shall take effect upon its passage.

Results of a Trial with the "Chamberlain Gas."

By Frederic Egner.

An article entitled, "The Chamberlain Gas Process," by Mr. Wm. Farmer, appeared in the American Gas Light Journal, date of April 2d, 1884, the closing sentence of which was the following: "Gentlemen, is this to be the gas of the future, or not?" If anyone ever had any doubt about that matter, and which is not yet settled, the following may possibly serve as a solution of the conundrum propounded by Mr. Farmer.

In January of this year certain parties called at the office of the Laclede (St. Louis, Mo.) works—of which plant the writer has the honor to be Superintendent and Engineer—with the purpose of explaining all about a patented method of making gas. Slight conversation led to the discovery that the visitors were interested in what is known as the Chamberlain process. They claimed to have obtained astonishing results, or similar to those described in the issue of the Journal mentioned above. When expostulated with because of the absurdity of the operation of that so-called process or scheme, they brought out the hackneyed story of Columbus and the egg, with more "evidence" of an equally trustworthy sort. They asserted that "Col." Chamberlain really had made a great chemical discovery, and clinched the whole argument by maintaining that they had—as a result of practical operation—positively proved all they claimed the process would accomplish. They only asked leave, *at their own expense*, to demonstrate these facts to us. It was evident these particular promoters of that process were thoroughly honest in their belief; and as they neither were nor claimed to be gas men, but only "thoroughly posted" as to that single process, it seems quite likely they themselves were deceived by that clever old gentleman, "Col." Chamberlain; judging so, at least, by the sequel, since this proved that out of the statements made by them, the "Col.," or contained in the article first referred to, none could be made good.

While our negotiations with these people were in progress it transpired that they were making efforts to obtain a footing in this city with some of the leading business houses, and they openly claimed to be doing the same thing in New York. So, bringing all things into consideration, it was thought best to let them demonstrate their claims—as they asked—at their own expense. They caused a 5,000 cubic feet gas holder to be built; bought a station meter and scrubber, and brought the rest of the apparatus on from the East; had it all set up in a place assigned them, and commenced operations. Their claim was, as may be seen by referring to the article mentioned before as having appeared in the Journal, that with 10 gallons of refined petroleum, 2½ gallons of water, with the necessary quantity of air, raised to a high temperature, 3,000 cubic feet of 18 to 20-candle power gas could be made and relied upon. Two bushels of coke was the quantity said to be required for fuel per 3,000 cubic feet of gas. A most valuable residual was to be secured. The residual was asserted to be worth, by the barrel, 75 cents per gallon, and it would make its appearance in the ratio of one-half gallon residual to each ten gallons of oil distilled. The process is covered by U. S. Letters Patent, Nos. 278,093, and 286,589.

A brief description of the apparatus may be interesting at this time. A cast iron retort, flat, about 4 feet six inches long, 26 inches wide, and 6 inches deep, was set into a furnace. Oil and water were run into the retort at one end, and the gas was taken off at the opposite end. When a certain quan-

tity of gas was thus made *air was pumped through the red-hot retort.* The gas passed from the retort through a water seal or washer, meter, and into the holder. A more utterly silly operation for gas making could scarcely be conceived; yet so convinced were the promoters of this folly that their patentee had really succeeded in changing one of the very fundamental laws of chemistry, that they looked on anyone who would try to undeceive them either in the light of an ignoramus or a foe. In order, however, to give the matter a fair trial, the "Chamberlain Gas" was brought through a special pipe directly into our photometer room. In another room a dozen jets were connected to a meter and left burning day and night for over 1,400 consecutive hours. The gas, which for the first 18 hours seemed to badly gum up the burners, did not do it after the expiration of that period, nor did it even show a sign of it again. The gas was brought to the burners in a very roundabout way, and showed no condensation nor sign of stratification whatever. The gas was slightly heavier than air, and the waving of an open hand near to a burner would extinguish the flame. It could not be tested with the London Argand, and a very wide slit, lava tip, flat flame burner was used at first; afterwards an Argand—especially made for that kind of poor gas—was obtained from the local water gas company and installed as a test burner. It was found that when 1,000 cubic feet of gas was made, using 3½ gallons of refined petroleum, the illuminating value would be all the way from 7 to 10 candles. 150° oil, 112 (fire-test) oil, gas naphtha, and intermediate distillate, all were tried. The oil gas (with water and without water) was made, then air pumped in, as the "Col." directed. The gas and air went through together. The air was put in cold, and then hot; and in fact in all the intervening stages all the possible changes that could be rung in were made. The same man (and a very ingenious old, gentlemanly mechanic he is) who made gas for the "Col." in New York conducted the experiments here. But it was all to no purpose. They never could make 3,000 cubic feet of gas at one time, nor in one day, although the apparatus was far more than double the size of the New York apparatus, and was *warranted* to make 10,000 cubic feet per 24 hours—before it was tried. As stated, every conceivable change in operating the "apparatus" was made; nor was the regulation quantity of oil adhered to. The thing was tried with three, and any quantity of gallons of oil more, per thousand; but the results were not satisfactory. The residual product turned out to be a nasty, stinking, tarry liquid, of no value whatever. As might be expected, the retort and pipes leading from it were often filled with lampblack.

In the course of the experiment the ingenious mechanic before referred to developed out of this "Chamberlain Gas Apparatus" an entirely different one, with which he obtained some really good results—*i. e.*, compared with the parent process; but enough has been shown now, at least in the opinion of the writer, to fully warrant the statement, "No, gentlemen; the 'Chamberlain Gas' is not to be the gas of the future." Not much.

Regulation of Pressure in Elevated Districts.

[A paper read by Mr. Robt. Mitchell, of Edinburgh, Scotland, before the North British Association of Gas Managers. Paper and discussion reprinted from columns of *Gas and Water.*]

In accepting the invitation of your President to make a few remarks on the subject of "the regulation of pressure in street mains (especially in elevated districts), and the duty of gas companies and corporations to their consumers in this respect," I did so, not because I had any misgivings as to the manner in which gas managers attended to this branch of their duties in their respective towns, but with the desire that we might, by the free interchange of opinion, arrive at a moderately clear understanding as to what gas consumers in the more elevated portions of our districts have a right to expect from the gas companies and corporations.

From the varied positions of gas works, and the variations in the levels of the area to be supplied, no fixed rule can be laid down for any two works as to the initial pressure to be recognized at the station governor. Every manager must be guided by the circumstances in which he is placed and these alone. In the distribution of gas it is of the utmost importance, and demands our most careful attention and consideration, that all gas mains, cross connections, and the whole ramification of service pipes are of ample size and in perfect order, so that a sufficient supply may be given to the district without excessive initial pressure, alike in the interest of gas company or corporation, and the consumer. In towns where the alterations of levels occur (as in some cases they do) in stages or terraces, the only system of distribution which would be thoroughly successful and scientifically correct, would be to divide the town into zones. In order to do this it should be so arranged to have a trunk main through the one end of the town, or the center of it (whichever was most convenient), and the supply for these stages or terraces taken off at right angles to the trunk main, with the pressure controlled by differential governors. It is not always expedient, yet in some cases it is so, to have a separate main from the distributing station direct to the district where the pressure is required to be greater or less than that on the larger portion of the town. Circumstances might necessitate special arrangements to be made to meet all the requirements; yet, where it can be applied, I am of the opinion that the trunk-main system would prove the only satisfactory method of distribution in districts where the variations of level were great. Where the supply is controlled by station governors alone, if the governors are correctly constructed, the area will be properly supplied, provided that there are but slight variations of level. Should variations occur of, say, from 40 to 50 feet, an alteration in the means of controlling the pressure should be adopted.

It is a well-known and recognized fact that where an increase or diminution in level to the extent of 10 feet occurs, an increase or diminution of pressure to the extent of one-tenth of an inch takes place, hence the desirability of this branch of our business receiving our careful consideration.

In laying out a new district you will make an approximation of the quantity of gas the district will require per hour at the heaviest season of the year, in setting out on the calculations necessary as to what size of pipe you will require to discharge the quantity at an initial pressure of not more than twenty-tenths, thus allowing what may be presumed a fair margin for increasing consumption in the locality. I will not trouble you by going into the formula by which any quantity of gas of varying specific gravities may be passed through pipes of various sizes and lengths. You are, no doubt, well acquainted with the elaborate tables compiled by the late Mr. T. G. Barlow, and which have recently been extended by Mr. Thomas Newbigging. To these tables I cannot do better than refer you. In them you will find much of interest, and I may add that a close acquaintance with them will enable you to treat in a thorough and practical manner whatever comes before you in this department of your work. One most important point is that the specific gravity to which these tables have been calculated is so very different from the specific gravity of the gas in Scotland (with few exceptions), that to arrive at the actual quantity of gas that would be discharged in every case, a correction requires to be made. The increased specific gravity being so great, a very greatly reduced quantity of gas per hour is discharged.

As an illustration of this I will revert to a statement made with reference to the introduction of 20-candle gas as a standard for Scotch gas, viz., "the reduced specific gravity of 20-candle gas compared with 28-candle gas would allow the district to be supplied by existing mains as well as they are at present." If I take a 10-inch pipe, supplying a gas of .400 specific gravity, I find at 1,000 yards from where the initial pressure of 1.5 inches is applied, the discharge will be 26.055 cubic feet. The same pipe, under similar conditions, supplying a gas of .530 specific gravity (which may be taken as a fair specific gravity for 20-candle gas) will discharge 22.636 cubic feet. We again take the same pipe and like conditions, and supply a gas of from 28 to 30-candle power, having an average specific gravity of .670 (which may be taken as representing the gas supplied by the great majority of Scotch gas companies and corporations). The quantity will be reduced from 26.055 cubic feet in the first instance to 20.134 cubic feet, or from 22.636 cubic feet of 20-candle gas to 20.134 cubic feet of 28-candle gas. As our first duty to our consumers is to supply light, you will pardon me if I reduce these last two quantities to sperm value, and give the exact difference in the quantity of light conveyed to the consumer. Thus you have—

$$20.134 \div 5 \times 120 \times 28 \div 7{,}000 = 1{,}932.8 \text{ lbs.}$$
$$22.636 \div 5 \times 120 + 28 \div 7{,}000 = 1{,}552.1 \text{ lbs.}$$
$$380.7 \text{ lbs.}$$

You will observe there is a deficit in illuminating power edual to 380.7 pounds of sperm. We would therefore require to have a delivery of 28.200 cubic feet of 20-candle gas to give an equal quantity of light as would be discharged by supplying 20.134 cubic feet of 28-candle gas. While making this reference I hope you do not mistake me. I have a great desire that a recognized standard should be adopted in Scotland, whatever that standard may be. Should it be agreed upon to introduce a uniform quality—say, 20-candle gas—then gas companies and corporations whose distributing plant is only equal to their present requirements, without much of a margin, must face the necessary cost of enlarging their mains and a considerable portion of the old service pipes, as well as their manufacturing plant, and those unfortunate consumers who have Wheatstraw fittings, will be compelled to have them enlarged, or content themselves with a proportionately small quantity of light. It may be said that this is a little outside of my subject, yet, if you have to force so much more inferior gas through existing mains, it simply comes to be a matter of pressure. Then the old rule that the discharge of gas from any main will be doubled by the application of four times the pressure must in part come into play. This mode of increasing the quantity of gas required to be passed to compensate for the reduced illuminating power I do not consider expedient, as it must be the experience of everyone here that, at low or medium pressures, we have least leakage and obtain the best photogenic results.

Having all main pipes, cross connections, and service pipes of sufficient size, the controlling of the pressure necessary to meet the requirements then commands your careful attention. Having decided upon what you may call the maximum or sunset pressure, it is not consistent with common reason that this pressure should be maintained throughout the entire evening as, I am sorry to say, it too frequently is the case in our smaller towns. I hold that to have one-tenth of an inch more pressure on your street mains than is actually necessary to meet the requirements of your consumers, is wasteful and wrong. Further, having once fixed the initial maximum pressure at which the various districts are to be supplied—and this should be done at least twelve times in a year, according to the seasons—the mode of increasing the pressure ought to be very gradual from the day pressure to the maximum of sunset pressure; the high pressure ought only to remain on until the heaviest hours of lighting are past, say, from 7:45 to 8 o'clock, according to the circumstances, when a reduction of two-tenths of an inch is made, and this operation is continued every half hour until 11:30; and at midnight the whole of the pressure ought to be reduced to as low as is safe. Were this care in the adjustment of pressures more generally adopted by gas managers the days of 15 to 30 per cent. of leakage would then become matters of history, and the consumers would not have to submit to excessive pressures, which in too many cases mean gas wasted, hence high gas bills. The last question is—what is the duty of gas companies or corporations to their consumers living in the more elevated parts of their districts who are subjected to excessive pressures? I hold it to be the duty of every gas company or corporation, whether by the system of zones, or by the use of differential governors, to use whatever means are best adapted to regulate the pressure on the whole elevated area, or in each individual case as may be considered most advantageous to the consumer. It ought to be that every gas engineer or manager should take for himself a higher platform than that of being merely a manufacturer of gas. His duty is, and his interest ought to be, in supplying his consumers with light in the very best possible manner. I would not for one moment entertain the idea that only a very small minority of gas managers are actuated merely by the desire to sell gas independent of its quality, and also independent of the comfort or satisfaction of the party supplied; yet we do find, now and then, the consumers receiving but very moderate consideration. I have long held the opinion, and as my experience increases I see more and more the advisability and the desirability of gas companies and corporations in their own interest, as well as in that of their consumers, taking the complete supervision of the internal fittings, in addition to that of their own street mains. Why should this not be so? I see no reason why gas companies and corporations should not have the power that water companies in a few of the large towns have, where all fittings must be of a given size and strength in conformity to a standard scale, and the whole work examined and passed by a qualified official before any water is allowed to pass through these pipes.

If this system of examination was exercised by gas companies and corporations (which I consider it is their duty to do), a very great amount of the inconvenience, loss, and annoyance to the consumers would be averted, not to mention the numerous and harassing complaints to the gas manager about inferior light supplied—the gas in many instances being condemned as bad when the whole cause of complaint, after it has been inquired into, has been found to result from inadequate or imperfect fittings, and, it may be, inferior workmanship.

Discussion.

Mr. Peebles said he had given some attention to governors, and he thought the division of the city into zones very commendable, for they had then the control over a certain limit of pressure and an easily got at system for controlling the particular zone. The differential governor, by the extended rises of gas, would not be of such use as they had been, as they responded only at the gas works. He thought the time had come when constant pressure governors would be a necessity. He had lately given his attention to that, and hoped to bring his invention before them next year, if not sooner. The governor he had in progress was a station governor, and by a small hand pump they could take up the load or reload it. There was now a great necessity for improvement in the day pressure, with the gas engines and cooking stoves now so widely introduced.

Mr. Burden (Musselburgh) said he had to put the pressure sometimes from two-tenths up to one and five-tenths, when there was a complaint of insufficient supply for gas stoves; but the real reason for complaint was the bad fittings. He held that before pipes were put into a house the gas manager should be consulted.

Mr. Somerville (London) said he knew a gas engineer who was in the happy condition of keeping up 25 tenths day and night, as so many gas apparatus had been introduced that they required just as much in the daytime as at night.

Mr. Key thought Mr. Mitchell had taken a very wise step in bringing this before the meeting, as the subject of street mains should be familiar to every student of gas manufacture, and they should know that meters registered better under a low than under a high pressure. He thought those who had to supply the gas should have power to see that the consumers' houses were properly fitted up.

Mr. Anderson (Dysart) did not see how, where they had a district supplied over a trunk main, they could regulate it without a governor at each branch.

Mr. M'Gilchrist did not see how, in a district like Edinburgh, where there was a difference of upward of 300 feet in the levels, they could ever successfully compete with the pressures by station governors. Supposing the pressure was an inch at the gas works, at the top of the castle it would be more than four inches; that being altogether out of the power of a station governor to regulate. With regard to the consumers' fittings, he had taken a very great interest in that subject, and for the last eight years the Corporation of Dumbarton had issued a standard of sizes which they supplied to all contractors and builders. The Dean of Guild Court took special note of the matter, and he had known them compel the removal of the pipes where they were contrary to the standard. By this system they had been able to reduce the pressure considerably.

Mr. Key—Is there a clause in the Dumbarton Gas Act to enforce this regulation?

The Chairman—You hear the question?

Mr. M'Gilchrist—I hear the question; and Mr. Key knows it as well as I do.

The Chairman—You are answered, Mr. Key.

Mr. Mitchell, in briefly replying, remarked that it had been said this was an old story; but it was one which could not be too well impressed.

The Chairman said the paper presented to him many points of interest, particularly as the lighting in Dundee was carried on in much the same way as had been pointed out by Mr. Mitchell. In the higher parts they had a high-level main, and even with three tenths of pressure at the gas works, at the summit it was found from twenty-seven to thirty tenths; and they found they could supply them without any pressure at all, so great was the vacuum. Before the introduction of governors their waste had been as high as 24 per cent.; now he was happy to say it was only 10.5. A model of Cowan's automatic apparatus for registering and regulating the pressure exhibited in the hall was pointed to by the President, who, in conclusion, tendered a vote of thanks to Mr. Mitchell for his paper.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Increasing Its Capital Stock.—On the morning of Wednesday, August 5th, a directors' meeting of the New York Equitable Gas Light Company was held, the especial object of same being to determine whether a 50 per cent. increase should be made to the capital stock of the corporation. It is understood that the directors present at the meeting represented an ownership of 17,000 out of the total of 20,000 shares of stock in the company, and they were unanimous in advocating the proposed capital increase. The reason assigned for the action is that the funds were required for plant extensions, which necessitated the purchase of some valuable real estate. The property either acquired or to be acquired consists of two plots located on both extremes of the city's water boundaries—the first embracing a block lying between 41st and 42d streets and East river; the second parcel fronts on the North river, and is bounded by 58th and 59th streets. It is understood that holders of record have the option of taking up the new stock (in due proportion) at par, and this comfortable arrangement easily explains why the Equitable manipulators had so little difficulty in "boosting" the price of their shares up to the outrageously high figure of 140 or thereabout. When this security sells "ex-option," we venture to predict that the "boosters" will have some trouble in causing it to reach the '40 notch once more. Of course the 50 per cent. increase in the capital means that three millions of dollars now represents the company's total stock issue. We must say, however, the real estate secured is most valuable property, and its selection reflects great credit on the sagacity of the purchasing agent or agents who made the choice.

But This Would Not Seem very Sagacious.—While we admit the sagacity of the gentlemen who negotiated for the New York city property mentioned in connection with the above item, we hold to the view that the "agent" or "adviser" who suggested to the managers of the Equitable Company that glory and money were to be made as a consequence of building an opposition gas works in Chicago, Ills., was woefully far from the mark. With the Consumers Company in charge of a receiver, and with Messrs. Forstall and Watkins selling a 20-candle gas at the figure of a dollar a thousand—and perfectly satisfied with the price, too—it would seem to a disinterested spectator, possessed of even slight knowledge of the gas business, that there was hardly "room" enough for an attempt by a third party to figure in the Lake City as the "champion of the oppressed gas consumer." Still, variety of opinion gives spice to living; and it also may be said that when the "living" is ended the "spice" can be turned to account as an aro-

matic souvenir of the dead—to say nothing at all about the fragrant memories sure to survive in the recollection of those who were "let in on the ground floor" in the item of stocks, bonds, etc. At any rate, it is on the cards that the Chicago council, by a vote of 30 to 4, granted the Equitable promoters the right to lay mains, etc., through the streets of the city. That of itself, however, may mean much or little.

THE MONKEY AND THE PARROT.—The Jersey City (N. J.) philanthropists—as represented by the United Gas Improvement Company on the one hand and Mr. Addicks on the other—have opened up hostilities. The Consumers Company commenced supplying gas some short while ago, and the Jersey City folks are reported to be now obtaining their gas supply at $1.25 per thousand. Those financially interested in the gas companies of Massachusetts might find it worth their while to make note of the Jersey City imbroglio.

ONE OR TWO CORRECTIONS.—In an "item" that appeared in the columns of the JOURNAL for July 16, and entitled "Certain Rumors Taking Tangible Shape," was conveyed the information that a controlling interest in the capital stock of the South Boston (Mass.) Gas Light Company had been secured by parties supposed to be interested in the Boston opposition gas scheme sailing under the name of the Consumers Company. Substantially the item was correct, the only inaccuracies in regard thereto being the following: The price paid for the shares was 110 dividend on, instead of 110 dividend off; or, the accrued dividend of 3 per cent. did not go to former owners. We have it on the best of authority that no meeting of the directors was held to consider the question; consequently "no vote was passed to sell the stock." If that was the case—and we are inclined to positively assert that such is the fact—the gentlemen interested in obtaining stockholders' assents to the scheme must have done some beautifully persuasive talking. In the meantime both Lowe and Addicks are "running loose" over Massachusetts in the attempt to persuade the stockholders of the Massachusetts gas companies that the latter should give their property away to either one of the former. The Messrs. Greenough, of Boston, J. C. Pratt, of Jamaica Plain; Pease, of East Boston; Dr. Estes Howe, of Cambridge; W. E. Fette, of Marblehead; W. Tarbell, of Waltham; and, in fact, numbers of other gentlemen who for years past have conducted the affairs of their companies on a thoroughly sound, honest and business-like basis, are not likely now to relinquish the fruits of their labors simply that the palates of the Standard Oil Company marauders may be tickled thereby. They got nettles in Chicago; and we hope that Massachusetts will afford them a mess of thistles. In the meantime do not forget that while Gibbs and Addicks are "running loose" in the Bay State, they are "running amuck" in New Jersey.

PERSONAL.—Mr. W. Elliot Fette, of Boston, Mass., has but recently returned from a trip across the ocean. While in England Messrs. Fette and M. S. Greenough (who also made a flying European trip) attended the sessions of the Twenty-second Annual General Meeting of the Gas Institute, and were greatly pleased at the reception accorded them.

THEY MIGHT CONSOLIDATE.—On the 26th day of May last a certain number of Brockton (Mass.) speculators obtained permission from the Brockton Board of Aldermen to maintain and operate a gas works in that city. The capital stock was fixed at $50,000, and the management of the enterprise was entrusted to a board of five trustees. A certain personage named J. J. Whipple (he prefixes his cognomen with the title of "Colonel") occupies the position of President. During the progress of the "moons" "Col." Whipple and his "Trustees" gave no sign of activity; but recently the "Col." has emerged from the shade of obscurity, and the "emerge" is traced to the fact that, like a true old war horse, he sniffed at the breezes springing from the Gibbs and Addicks gas war—and thought he "smelled a bone." Did not the "Col." have a charter? and the old Brockton Gas Company did not want it. Perhaps we misjudge him; but we base our opinion on the following, extracted from the Boston *Journal*, date of July 20th: "Col. Whipple said that while people had been of the opinion that the Economic Company"—for such is the name of the "Col.'s" corporation—"was sleeping, it would soon be shown that it was wide awake." Colonel Whipple was rather reticent on the subject, but admitted that it was not improbable his company, which as yet possesses neither plant nor works, might consolidate with one of the Philadelphia companies for the purpose of opposition. Of course, "Col.;" why not? It would not cost you very much.

THE NEW SUPERINTENDENT.—The place made vacant in consequence of the murder of Mr. Geo. S. Dunbar, former Superintendent of the Pittsfield (Mass.) Coal Gas Company, has been filled by the appointment of Mr. Jno. F. Dunbar. The new incumbent bore the relation of brother to deceased, and was formerly in charge of the plant known as the Union Gas Works, of Pittsfield, the function of the latter being to furnish gas to several large mills located in the northerly portion of the city. We regret to say that the slayers of Mr. Geo. S. Dunbar remain undiscovered. Mr. W. R. Plunkett, Secretary and Treasurer of the Pittsfield Company, will accept our thanks for the information furnished us.

THE PINTSCH SYSTEM.—The Pintsch system of illumination is surely and steadily gaining ground and favor. From a foreign source we learn that four more buoys on the Pintsch principle have been shipped to the Suez Canal to be there employed as beacons. This last shipment brings the total number in use on that canal up to 12. The first sample of a new pattern of gas beacon has just been placed in the Clyde on the Gantoch Rocks. This beacon shows two red lights, and will perform its duty over a period of five weeks with one charging of gas. Up to a recent date the following numbers of railway carriages and engines were illuminated by this system in the sections specified: Germany, 13,475; England, 2,926; other districts in Europe and America, 3,923, or a total of 20,324.

CARBOLCRYSTAL.—Mr. Wm. H. H. Childs, of 73 Maiden Lane, N. Y. city, is a gentleman who is recognized as one of the best authorities, in the matter of working up the products from the coal tar of gas works, in this country. He has recently succeeded in developing an excellent disinfecting material, to which he has given the name carbolcrystal. It is neither poisonous nor corrosive, and experts assert that it is eminently well adapted to take the place of carbolic acid in household use. It is put up in three distinct shapes—liquid, powder and solid.

NOTE.—The Flatbush (L. I.) Gas Light Company's main system has been overhauled. Several improvements have also been instituted in and about the works proper. It is a well-kept establishment.

NEW ZEALAND LIGNITE.—Mr. D. A. Graham, Engineer to the Dunedin (New Zealand) Corporation Gas Works, contributed the following interesting particulars to a recent issue of the London *Journal:* "In the neighborhood of Dunedin there are large lignite coal fields. I have tested samples from one of the principal mines (Kiatangata) and various other lignites, and find their composition to be as follows:

Yield of gas	13,000 cubic feet.
Illuminating power	8 candles.
Water in coal	620 pounds.
Tar produced	51 "
Ash	5 per cent.

"In Dunedin, Kiatangata lignite is used to prevent the ascension pipes stopping, which, I am informed, it does very effectually. If the gas it produced were tested, I imagine it would be found principally of marsh gas and hydrogen. I was induced to give it a trial on a commercial scale, with very peculiar results. The whole of the condensing apparatus became so hot within two hours after the trial commenced that I could not bear my hands on the condenser. The charges were burnt out in less than three hours. The purifiers became hot and fouled; and, as a consequence, when 18-candle gas was reduced to 13, in three hours' working, I had to abandon its use. It will be seen that the quantity of water present in the lignite is enormous. I have not renewed my experiments on a large scale, nor am I desirous of doing so; and I cannot state to what this abnormally high temperature was due. The facts were as I have stated them; and it is also the case that lignite cleans out and keeps clean stopped ascension pipes."

THE TROY (N. Y.) HEATING GAS SCHEME.—On the afternoon of August 4 the directors of the Troy heating gas company (the concern which is understood to have succeeded to the property of the defunct Troy steam heating company) held a meeting for the purpose of organization. C. McVeagh, of New York city, was elected President; C. McCarthy, Vice-President; and G. Geer, Secretary; the two last named are residents of Troy. By resolution it was determined to purchase a plot of land (325 by 138 feet) on Douw street, at a cost of $7,500; and it was further agreed that the erection of a gas plant on the selected site be immediately proceeded with. A holder, 50 feet diameter, will be put up at once, it being the intention of the proprietors to construct one of double that capacity "later on." [We presume the "later on" means when the business of the company will justify the proceeding—a very indefinite outlook, that.] The main conduit, from works to old steam heating mains, will be 12 inches in diameter, and the initial main service of the company will be about six miles in length. It is expected that the company will be ready to send out gas for heating purposes in sixty days from time of starting in on erection of the buildings. The second meeting of the directors was to be held in New York city on August 15, and a Superintendent was then to be chosen. The cost of the projected work is placed at $75,000.

WHAT THE MANSFIELD (OHIO) GAS MEN ARE DOING.—When the Northwestern Electric Lighting Company, of Chicago, Ills., announced its intention of instituting a branch plant at Mansfield, Ohio, Mr. George S. Harris,

Superintendent of the Mansfield Gas Light Company, did not show any marked symptoms of perturbation; and, in fact, rather welcomed the appearance of the enemy, since the advent of the newcomer would but serve to prove to the people of Mansfield what a good and cheap article of gas was really worth when compared with its would-be rival, electricity. Supt. Harris appears to have estimated rightly, for since the electrical promoters commenced supplying the "light of the future" the output of the gas company has been greatly increased. In fact the demand for gas has grown to such proportions as to make necessary an extensive system of additions to the old works, and these enlargements are now in vigorous progress. The new construction includes a brick retort house, 35 by 60 feet, with trussed roof and all modern improvements; a new holder, with a calculated capacity of 70,000 cubic feet; and new purifying apparatus. The per diem working capacity of the old plant was but 65,000 cubic feet, while the new apparatus will place the company in position to supply a daily send out of 150,000 cubic feet. Hancock & Dow, of Mansfield, are the contractors for the erection of the brickwork on retort house, as also for tank construction; Messrs. Wm. Gardner & Son, of Pittsburgh, Pa., having secured the award for all ironwork and supplies. The Mansfield gas folks are quite satisfied with the illuminating product afforded by Youghiogheny coal, and have resisted the cajolings and threats of the water gas marauders. Their consumers are satisfied, while the stockholders have nothing to grumble over. The following are the gentlemen who manage the affairs of the Mansfield corporation: Jno. B. Netcher, President; Leroy Parsons, Secretary; Geo. S. Harris, Superintendent; and Messrs. Jas. Gardner, of Cumberland, Md.; Jno. McIlhenny, of Philadelphia, Pa.; Lyman A. Strong, Jas. Hedges, and S. E. Bird, of Mansfield, Directors.

A Slight Blaze.—One evening toward the close of last July a large crowd of Bostonians gathered on a certain part of Winter street and watched, with much curiosity, the burning of the woodwork upholding an electric lamp. The flames had been started by some unexplained diversion of the electric current, and were not extinguished until that portion of the circuit was shut off from connection with the central station. These slight fires are of frequent happening in all American cities where arc street lighting is in vogue; and, although happily they do not often result in serious damage to property, still they go to prove that incessant watchfulness must be exerted in order that the vagaries of the current may be noted and corrected in time.

The Situation at Louisville, Ky.—The opposition combination at Louisville does not seem to be making much headway, and in fact the outcome of the Chicago, Ills., situation appears to have caused great uneasiness in the camp (or menagerie) of the Louisville strikers. Quite naturally the old Louisville company was not slow in "posting" the home brokers as to the collapse of the Chicago Consumers' Company; and Mr. Fitch and his backers "awaking to the gravity of the situation," strove to offset the effect thus produced by the publication of an article in the local newspapers which explained that the promoters of the "enterprise" were "backed by unlimited means," etc., and that they were connected with people who "knew no such word as fail." Possibly not; but it does seem as though they would ere long have a thorough acquaintance with that very word. From a gentleman recently returned from a visit to the South and West, we obtain the following particulars regarding the Louisville situation. The capacity of the opposition plant approximates to a daily supply of 200,000 cubic feet, and its main system may be placed at a length of 10¼ miles. That the latter was poorly laid will be shown further on. Upon this property one-half million dollars' worth of bonds were issued, and of this sum all were placed save about $50,000. This remaining portion has been hawked about for some time, "in lots to suit purchasers' fancy," at the figure of 70 cents on the dollar, and even less. The "securities," however, remain undisposed of. The opposition has secured in the neighborhood of 600 consumers, 500 (in round numbers) of which it may be asserted were taken from the old company, the balance, of course, being chargeable to "new consumption." Of the 500 originally taken from the Louisville Company, about 5 per cent. (and they were the most desirable ones to secure) have voluntarily renewed their allegiance. The daily output of the opposition ranges between 75,000 and 80,000 cubic feet. As an instance of the grossly negligent manner in which the new company's mains were put down, it may be stated that, on one of the principal avenues in the city, 180 handsome shade trees, planted within a distance of 8 or 10 blocks, were killed. A florist, whose extensive greenhouses were located in the same territory, suffered to such an extent that he sued for $2,500 damages—making both companies defendants to the suit. It is supposed he impleaded the Louisville Company simply that the testimony of its managers might be secured. Our informant bases his belief that the water gas folks were at fault on the ground that they stripped and repaired that section of their pipe, while the Louisville Company took no action in the premises—the result being that in due time after the water gas mains were made tight the contents of the greenhouses gradually resumed normal condition. As to the old company's progress, it has made a *net* gain, as shown by its books, of 490 consumers. Its output for each month of year has made a gain—save in the case of last July; when (and presumably owing to the extremely warm weather experienced) a shrinkage of 40,000 cubic feet was recorded. The directors have declared a 2 per cent. dividend, and a good balance was carried over to the satisfactory side of profit and loss account. The company still maintains the 95 cents per thousand figure in the disputed district, and it would seem as though the rate might yet be further decreased. President Morris, the Board of Directors, and Engineer Barret, are of one opinion in this "fight," and the probability is that those bonds would be a rather bad sort of purchase at 70—or under.

A Note from Worcester, Mass.—Supt. J. H. Rollins, of the Worcester Gas Light Company, by way of seeking rest and recreation during the heated term, is busying himself with carrying out an extensive system of repairs and alterations to plant. Twelve of the old benches of fives have been torn down, and the stacks are to be reconstructed in accordance with the most advanced ideas. In the new order of things four of the Dieterich pattern furnaces are to be installed, as also two of the McIlhenny plan; the remaining benches to be heated under the old system. A new hydraulic main of wrought iron, constructed on the incline principle (incline 3 inches to the foot), is to be put in, and all auxiliary pipes are to be spick and span new samples of the moulder's art. The Baltimore (Md.) Retort and Fire Brick Company, through their Boston agents, the Messrs. Waldo, are to furnish the fireclay goods; and Messrs. Davis & Farnum, of Waltham, Mass., are to furnish and erect the iron work. When the contractors have finished their work, it is estimated that about $23,000 will have been expended. Now, the foregoing would appear to show that Brother Rollins and the Worcester Company's Directors are not disposed to give up the manufacture of coal gas just yet. The general verdict "down East" appears to drift in the direction that water gas is a pretty good thing—to have but little to do with.

Mortgaging the Works.—The stockholders of the Union Gas Light Company, East New York, L. I., have recently given their consent to have the property mortgaged in the sum of $250,000. The object or purpose necessitating the mortgage issue has not transpired.

They Still Own the Place.—In our issue of July 16th it was stated that the city authorities of Detroit, Mich., extended an invitation to the Detroit Gas Light Company to bid on the public lighting for ensuing year. The gas company's bid, including repairs, etc., was $45,000; the Brush Electric Lighting Company's figure for same work, without repairs, was $89,000. In spite of the disparity, amounting to the round sum of $44,000 for a twelvemonth of public lighting, the electric folks will get the contract for '85. In our July 2d issue we also referred to this matter, and then said it was supposed the "Brush Company came pretty near to owning the public authorities at Detroit;" and, viewed in the light of subsequent developments, we fear the supposition still holds good.

A Sample of Indoor Arc Electric Lighting.—Brooklyn, N. Y., in spite of the fact that it ranks as number three according to the U. S. Census Reports statement, or enumeration of dwellers in our large cities, and now boasts that her precincts contain at least 750,000 souls, has but one really good restaurant. It is designated the "Clarendon," and is located on the spot made famous through that terrible holocaust (known as the "Brooklyn Theater fire") of some years ago. The main dining room is most tastefully decorated, and attached to its ceilings are a number of elegant chandeliers, the burners of which are quite equal to the task of illuminating the premises with thorough efficiency. The proprietors of the place, however, decided that "one good, strong electric light would furnish all the lighting effect necessary," hence the installation of "a 2,000-candle power arc light." Between glare and somberness a "lighting effect," exasperatingly unique in its way, is now afforded the diner. The arc will persist in "going out" with great frequency; and if one did not care much as to whether or not he got anything to eat, it would be most amusing to follow the artists of the black jacket and white apron in their hasty endeavors to "turn on the gas." Then, again, one's ears are saluted with a hissing nocturne but poorly calculated to enhance the "pleasures of the banquet." The reason advanced by the proprietors for this disagreeable illumination is, "Gas makes the place so hot, you know." In view whereof we would suggest that Brother Stein, of Philadelphia, might be prevailed upon to suggest to the Brooklyn restaurateurs (via the Brooklyn Gas Light Company) that a Siemens high power lamp would do away with the "heating" objection, and thus enable people to peacefully enjoy the viands so skilfully prepared by the Clarendon's able *chef*.

Reducing Gas Prices at Taunton, Mass.—Mr. H. B. Leach, Supt. of the Taunton Gas Light Company, notified the customers of that corporation, under date of July 23d, that from and after October 1st, 1885, the following charges would rule: A consumption of less than 125,000 cubic feet per quarter, $1.75 per M.; over that quantity, $1.50 per M. The Taunton folks are always "up to the times."

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—JOS. R. THOMAS, C.E
Manager—C. E. SANDERSON.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

This is a recognised official organ of—
LIGHT, HEAT, STEAM, WATER-SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE.

TERMS

SUBSCRIPTION—Three Dollars per annum, in advance.

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MONDAY, AUGUST 17, 1885.

Pyrometers.

The London *Journal of Gas Lighting* says: There is great need for a reliable pyrometer, capable of directly measuring and indicating the temperature of all kinds of furnaces. Herr Seger, speaking upon this subject at a recent meeting of the German Union of Manufacturers of Refractory Products, stated that, so far, no pyrometer had proved so satisfactory as to establish itself in general use among potters, etc. For temperatures above 500° C. all patterns of pyrometers cease to be reliable, and cannot be safely used for regulating the temperature of porcelain kilns and furnaces of a similar kind. The Siemens electric pyrometer is not trustworthy, as, even with the most careful handling, repeated use vitiates the action, so that different instruments hardly ever give corresponding indications. This apparatus also requires frequent repairs. There is only one other device—the circulating water pyrometer——for registering the temperature of closed furnaces; and this is a cumbrous and immovable arrangement susceptible of only limited use. For many purposes what are called pyroscopes are employed to give approximate indications of the temperature of ovens and flues the interiors of which are open to inspection. Fusible alloys of metals are sometimes used for this purpose; the more satisfactory (up to their limits of application) being inoxidizable alloys of gold and silver, or gold and platinum. These, however, are not recommended for temperatures above 1,200° C. In fire brick and porcelain works use is frequently made of a graduated series of mixtures of fire clay and ground felspar; also of felspar, quartz, and fire clay. These mixtures are moulded into cubes of about an inch, and are placed in the flues or kilns so that they can be inspected through sight-holes in the furnace walls. The approach of the fusion temperature is shown by the rounding off of the corners of the cubes. These indications are, of course, sufficient for immediate practical purposes, but they do not show the temperature attained by any thermometric scale, and therefore fail in the desirable feature of registration,

Gas Engines of Large Power.

The Company engaged in the manufacture of the Otto gas engines at Deutz, Germany, have recently erected a water works to the order of the authorities of the city of Duren. The pumps of the establishment are driven by two Otto gas engines, each of forty-horse power. The same company have a similar contract which they are carrying out at Coblenz, where they will install two forty-horse engines; and in addition to the above they will equip the city of Quedlinburg with a water supply plant, and operate the pumps thereof with gas engines.

While, at the prices generally charged for gas in this country, it may not be in line with economy to employ gas engines in the running of water works pumps, exceptional prices, or those approximating to the cost of gas in holder, may make such plants possible even in the United States—especially in localities where the gas and water supply arrangements are in the hands of one corporation.

That there is economy in gas power over steam power—comparing, pound, for pound, the energy evolved from coal—has already been demonstrated through the medium of practical illustration. The most recent instance that we have of this fact is afforded by the Lead Mining Company of Metternich, Germany, the proprietors of which are now building a gas works, the function of same being to supply force to gas engines whose total horse power is estimated at 400.

Refrigerating Machines.

An exchange says that the great advantage of ammonia for refrigerating purposes, over ether, and more particularly over dry air, is that the required effect is gained by a smaller expenditure of fuel. Ammonia boils at a temperature of 30° F., at atmospheric pressure, and has a vapor tension of 120 pounds per square inch at 65° F. It has a latent heat (by equal weight) of 900. Ether, on the other hand, boils at 90° F., at atmospheric pressure, has a vapor tension of about 10 pounds, while the latent heat is, by equal weight, 162, and by equal volume, 369. Air, of course, is not condensable, and does not enter into the comparison on the same basis. Putting theory, however, on one side, Mr. Jno. Chambers, of New Zealand, states that his machine, which is designed to do the same work as a dry air machine delivering 60,000 cubic feet per hour, will work with about 1 ton of coal per 24 hours, while the air machine will require four tons for the same work. It will keep a storage space of 20,000 cubic feet, enough to hold 7,000 carcases of sheep, at a temperature of zero, and occupies an area of 306 square feet, the cubical measurement required being 2,295 cubic feet. At a higher temperature, say, 15°, a larger space can be kept cool.

Something Curious.

Les Mondes avers it has been noticed that laborers who work barefooted upon asphalt pavements are subject to swelling of the limbs, which has been attributed to the vaporization by the heat of the feet of a small quantity of the petroleum or mineral oil which is contained in the asphalt. The nerves of the feet which govern muscular action and the contraction of the blood vessels form an extensive and very sensitive nervous network under the arch of the foot, where the skin is always thin, and the nerves are consequently easily affected.

A REMARKABLE occurrence is reported from Glasgow, which, in spite of the approach of the gigantic gooseberry season, is probably true. A constant and brilliant flame, 4 or 5 ft. high, is ascending from the waters of the Clyde. For some time gas has been bubbling up through the water, and this was ignited a few days ago by an angler in lighting his pipe. It is supposed the gas comes from mineral working below.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 WALL ST., NEW YORK CITY.

AUGUST 17.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	94	95
Central	440,000	50	60	70
" Scrip	220,000	—	47	57
Equitable	2,000,000	100	136	140
" Bonds	1,000,000	—	107	110
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	113
Mutual	3,500,000	100	135	137x
" Bonds	1,500,000	1000	104	107
Municipal, Bonds	750,000		—	—
Northern	125,000	50	50	—
" Scrip	108,000			
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	130	132
Citizens	1,200,000	20	84	86
" S. F. Bonds	320,000	1000	106	110
Fulton Municipal	3,000,000	100	158	160x
" Bonds	300,000		104	108
Peoples	1,000,000	10	86	88
" Bonds	290,000	—	105	110
" "	250,000	—	90	95
Metropolitan	1,000,000	100	94	96
Nassau	1,000,000	25	125	127x
" Ctfs	700,000	1000	98	99
Williamsburgh	1,000,000	50	155	160
" Bonds	1,000,000	—	111	114
Richmond Co., S. I.	300,000	50	64	75
" Bonds	40,000	—	—	—
Out of Town Gas Companies.				
Buffalo Mutual, N. Y.	750,000	100	80	85
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	103	115
" " Bonds.	124,000	—	105	110
Chicago Gas Co., Ills	5,000,0000	25	130	140
Peoples G. L. & C. Co., Chicago, Ills			8	12
Cincinnati G. & C. Co.			180	182
Consolidated, Balt.	6,000,000	100	42	43
" Bonds	3,600,000		107	107½
Central, S. F., Cal.			—	58
Capital, Sacramento, Cal.			56	—
Hartford, Conn	750,000	25	123	129
Jersey City	750,000	20	145	—
Laclede, St. Louis, Mo.	1,600,000	100	100	105
Louisville, Ky	1,500,000	50	95	100
Montreal, Canada	2,000,000	100	181	182½
New Haven, Conn		25	166	170
Oakland, Cal			29	30
Peoples, Jersey City		—	45	—
" " Bonds			—	—
Paterson, N. J		25	90	—
Rochester, N. Y		50	75	80
Washington, D. C	2,000,000	20	212½	—
Wilmington, Del		50	199	210
Yonkers		50	41	44
St. Louis, Missouri	600,000	50	—	625x
San Francisco Gas Co. San Francisco, Cal.			56¾	57½
Havana (Cuba) Gas Co.	3,000,000	100	8	—
" Bonds	550,000			

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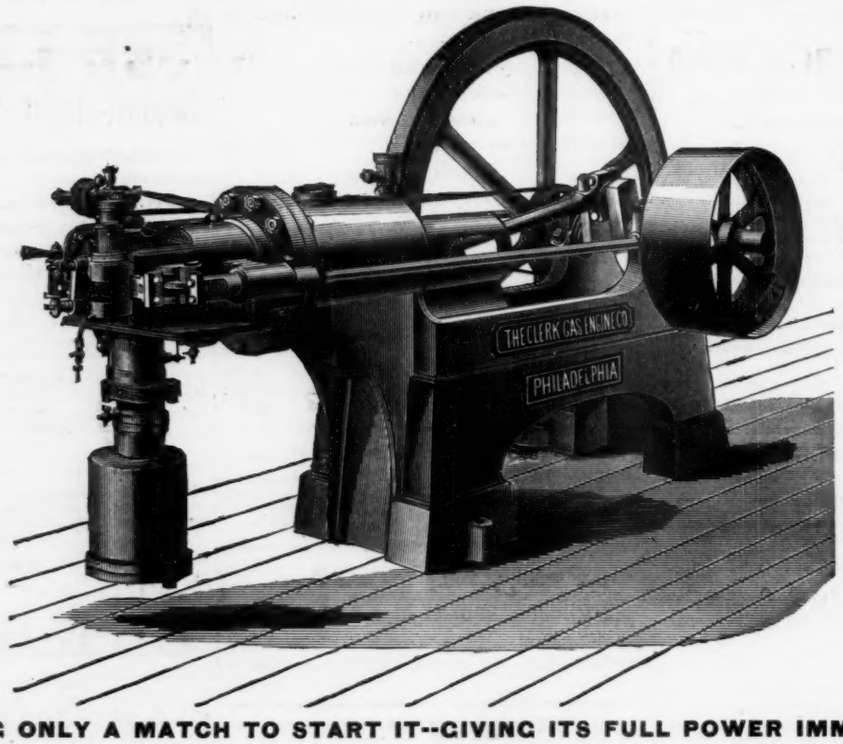

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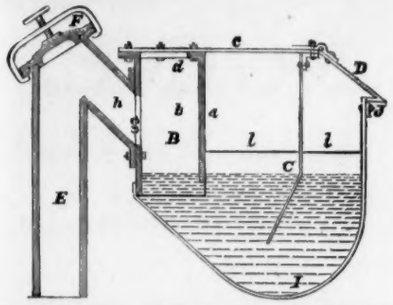

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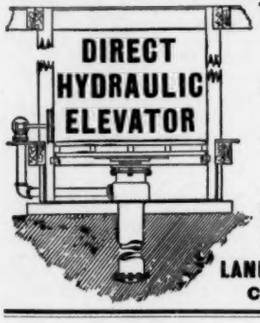

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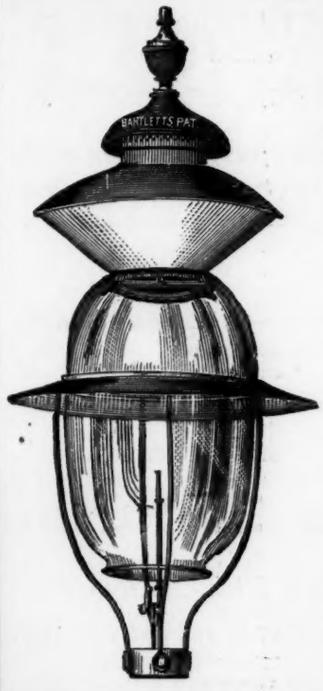

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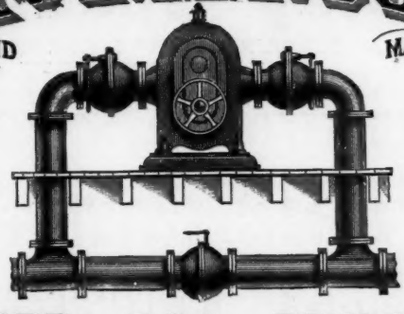

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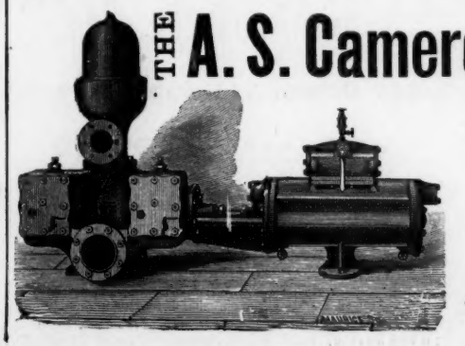

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THE AMERICAN METER CO.,

Large Flat Flame Burners.
15 cts. each, $1.50 per doz.

A test with these burners, with 18-can. gas, gives the following results:

No.	Pressure.	Consump. per H'r	Candle Power
		Cu. Ft.	
20	1.00 in.	7.75	38.00
30	1.00 in.	9.00	42.50
40	0.85 in.	10.30	44.54
60	.....	.....	.....

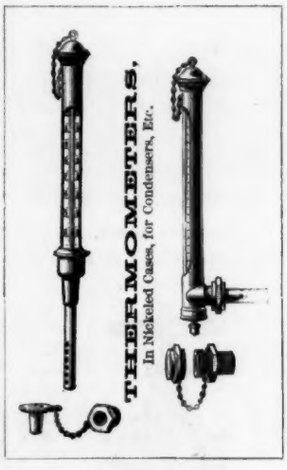
BURNER, by use of which Gasoline Stove is changed to Gas Stove.

Gasoline Stove.

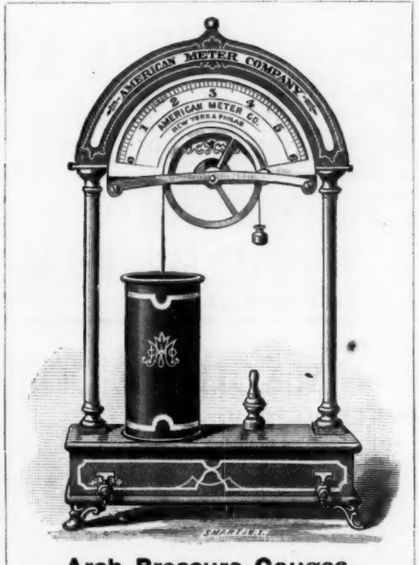
MANUFACTORIES,

508 to 514 West Twenty-second St., N. Y. **Arch and Twenty-second St., Phila.**

Nos. 244 & 246 North Wells Street, Chicago, Ill.



THERMOMETERS.
In Nickeled Cases, for Condensers, Etc.



Arch Pressure Gauges.
Japanned and Nickeled. Sizes: 3 in., 4 in., 6 in., 9 in.

SIPHON
Pressure Gauges.

4 inch,	Nickeled.
6 inch,	"
8 inch,	"
10 inch,	"
12 inch,	"
14 inch,	"
16 inch,	"
18 inch,	"
20 inch,	"
24 inch,	"

AGENCIES,

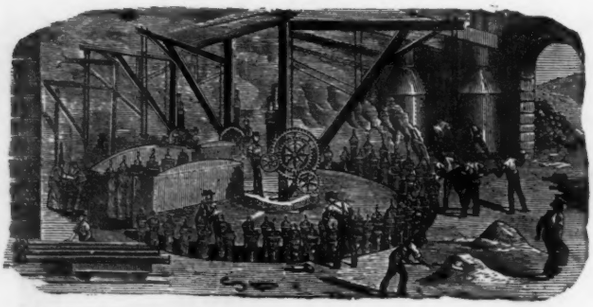
No. 177 Elm Street, Cincinnati, Ohio. **Nos. 122 & 124 Sutter Street, San Francisco Cal.**

No. 810 North Second Street, St. Louis, Mo.

A. H. M'NEAL,

BURLINGTON, N. J.

Flange-Pipes



General Foundry Work.

CAST IRON PIPES

FOR WATER AND GAS.

JAMES S. MOORE, Pres. BENJAMIN CHEW, Treas. JAS. P. MICHELLON, Sec. WM. SEXTON, Supt.

GLOUCESTER IRON WORKS,

GLOUCESTER CITY, N. J.

Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders. &c.

Office No. 6 North Seventh Street, Philadelphia.

ESTABLISHED 1856.

WARREN FOUNDRY AND MACHINE CO.,

WORKS AT PHILLIPSBURGH, N. J.

NEW YORK OFFICE, 162 BROADWAY.

Cast Iron Water and Gas Pipe

FROM TWO TO FORTY-EIGHT INCHES DIAMETER.

ALSO ALL SIZES OF

FLANGE PIPE for Sugar House and Mine Work.

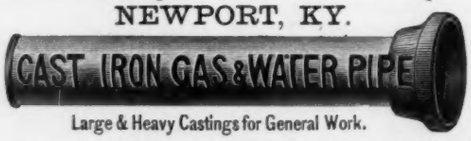
Branches, Bends, Retorts, Etc., Etc. 435-1

MATTHEW ADDY, President. W. L. DAVIS, Selling Agent. GEO. P. WILSHIRE, Sec. & Treas.

Cincinnati and Newport Iron and Pipe Company,

NEWPORT, KY.

Lamp Posts AND BENCH CASTINGS A Specialty.



Large & Heavy Castings for General Work.

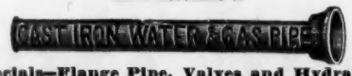
Branch AND SPECIAL CASTINGS FOR GAS & WATER Co's.

Manufacture Pipe from 2 to 48 inches. All work guaranteed first quality.

Mellert Foundry and Machine Co.

Limited. Established 1848.

MANUFACTURERS OF



Specials—Flange Pipe, Valves and Hydrants, Lamp Posts, Retorts, etc.

Machinery and castings for Furnaces, Rolling Mills, Grist and Saw Mills, Mining Pumps, Hoists, etc.

GENERAL OFFICE, - - - READING, PA.

CAST IRON

Gas and Water Pipes,

From 2 to 48 Inches in Diameter.

FOX & DRUMMOND,

160 Broadway, N. Y. City.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

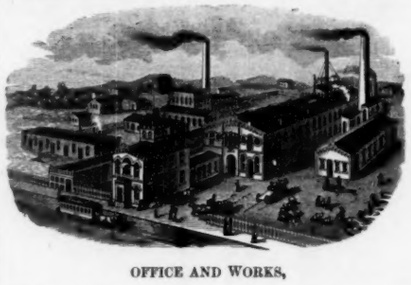
BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

LUDLOW VALVE MFG. CO.



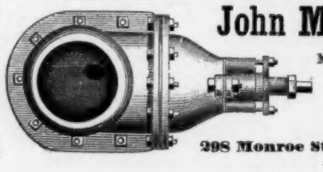
OFFICE AND WORKS,

938 to 954 River Street and 67 to 83 Vail Av.

TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants. Send for Circulars.

Valves.—Double and Single Gate, ¼ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil. nd for Circulars.



John McLean

Man'facturer of

GAS VALVES.

298 Monroe Street, N. Y.

Siemens's Regenerative Gas Burners,

For Lighting and Ventilating.

THE CHEAPEST, PUREST, AND MOST BRILLIANT OF ALL GAS LIGHTS.

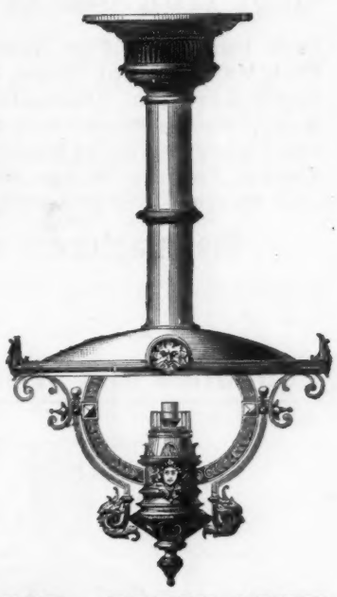
Superior to the Electric Light in Economy, Beauty, & Steadiness.

SPECIALLY ADAPTED FOR LIGHTING HALLS, FACTORIES, OPEN SPACES, ETC.

Numerous Tests made by various Gas Companies in the United States show an Efficiency of Ten Candle Power per Cubic Foot of Gas.

General Agents:

SIEMENS LIGHTING CO., 347 West Main St., Louisville, Ky.
MEYER, MARSHALL & CO., 528 California St., San Francisco.
DENNEHY, WOLF & O'BRIEN, 85 & 87 Dearborn St. Chicago, Ill.
WILCOX & McGEARY, - No. 11 Bissel Block, Pittsburgh, Pa.
T. T. RAMSDELL & CO., - 20 Swan Street, Buffalo, N. Y.
SIEMENS GAS ILLUMINATING CO., Room 6, No. 157 Broadway, New York City.
W. D. COLT, - - - - 1420 F Street, Washington, D. C.
JOHN KIEFER, - - - 344 Lawrence, Street, Denver, Col.



THE SIEMENS REGENERATIVE GAS LAMP COMPANY,

SOLE MAKERS FOR THE UNITED STATES,

N. E. Cor. 21st. St. and Washington Av., Philadelphia. Pa.

THE "STANDARD" WASHER-SCRUBBER,

KIRKHAM, HULETT & CHANDLER'S PATENT.

Total Capacity per 24 Hours of "Standard" Washers Ordered During the Following Years.

1877	4,000,000 cubic feet.
1878	4,750,000 "
1879	24,545,000 "
1880	42,967,500 "
1881	36,462,500 "
1882	39,300,000 "
1883	57,735,000 "
1884	26,177,500 "
Total	235,937,500 cubic feet.

Total Number and Capacity per 24 Hours of "Standard" Washers Erected and in Course of Erection in the Several Countries

	Number.	Cubic Feet per Day.
Great Britain	151	157,070,000
Western Hemisphere	38	39,337,500
Australia	18	12,150,000
New Zealand	2	650,000
France	6	4,550,000
Belgium	8	5,420,000
Germany	16	8,200,000
Holland	4	4,160,000
Denmark	1	150,000
Russia	2	3,500,000
Spain	1	350,000
India	1	400,000
Total	248	235,937,500

THE CONTINUED POPULARITY

Of these Machines

Will be recognized from the following extracts from letters from representatives of some of the companies having them in use:

PROVIDENCE GAS COMPANY,
PROVIDENCE, R. I., Nov. 24, 1884.

GEO. SHEPARD PAGE, Esq., New York:

Dear Sir—We are now using less than a gallon of water per thousand in the "Standard," and the gas at the outlet will not color turmeric paper.

Yours etc.,
A. B. SLATER, Treasurer.

PORTLAND GAS COMPANY.
PORTLAND, ORE., Nov. 29, 1884.

GEO. SHEPERD PAGE, New York:

Dear Sir—Our Scrubber appears to run to our entire satisfaction, and we are pleased to say that it takes out all the ammonia from the gas. This is *very* satisfactory to us, as we were ruining our meters at a fearful rate heretofore. The amount of water used is very inconsiderable as compared with our old process. The machine runs very smooth and still. Very respectfully,

H. C. LEONARD, Secretary.

"Standard" Washers Ordered Recently.

	Cu. Ft. per Day
Anneberg Gas Co	200,000
Bombay Gas Co	400,000
Brussels Co	1,250,000
CHICAGO, two, 1,000,000 each	2,000,000
Chemnitz Gas Co	1,000,000
CITIZENS GAS CO., BUFFALO	750,000
Coke Works in Zabre, Ober-Schlesien	1,500,00
Cokerei der Friedenshutte, Upper Silesia	700,000
Dumfries Corporation	250,000
Dunedin Gas Co., New Zealand	400,000
GEORGETOWN, D. C	250,000
King's Lynn Gas Co	300,000
Leiden, Holland	600,000
Lincoln Gas Co	400,000
Liverpool Gas Co	2,000,000
" "	3,000,000
LOUISVILLE GAS CO	1,500,000
Numea Gas Co	100,000
PITTSBURGH GAS CO	1,500,000
PAWTUCKET, R. I	500,000
PORTLAND GAS CO., Oregon	562,500
SAN FRANCISCO GAS CO	4,000,000
Sheepbridge	40,000
ST. LOUIS GAS CO	2,000,000
Sydney Gas Co	2,500,000
WASHINGTON, D. C. GAS CO	2,000,000
Whitchurch Gas Co	175,000
Total	29,677,500

GEO. SHEPARD PAGE, No. 69 WALL STREET, NEW YORK,

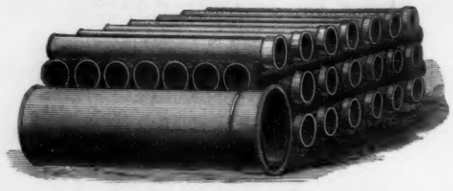
SOLE AGENT FOR THE WESTERN HEMISPHERE.

R. D. WOOD & CO.,

400 Chestnut Street, Phila., Pa.

Cast Iron Gas & Water Pipe, Water Machinery & Gas Apparatus

Cast Iron Pipe, Fire Hydrants, Eddy Valves, Lamp Posts, Large Loam Castings, Flanged Pipe, Sugar House Work, Iron Roofs and Floors, Wrought & Cast Iron Tanks, Turbine Water Wheels and Pumps.



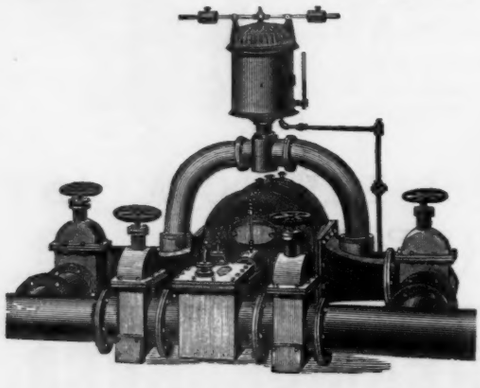
Gasholders, Lime Trays, Center Valves, Purifiers, Bench Work, Exhausters, Condensers, Governors, Scrubbers, Gas Valves Station Meters, Cast Iron Pipe Fittings.

Manufacturers of Heavy Castings and Machinery of Every Description.

ENGINEERS & CONTRACTORS FOR THE ERECTION OF GAS WORKS, & ALL MACHINERY CONNECTED THEREWITH

Estimates and specifications furnished for erection of new works or the extension or alteration of old ones.

Foundries and Works. - - Millville, Florence, and Camden, N. J.



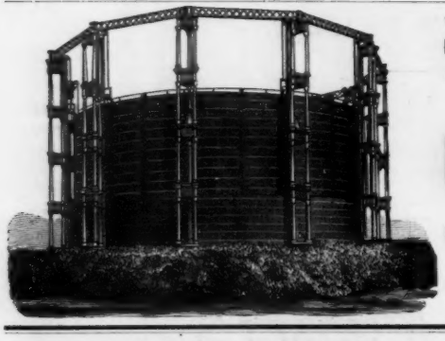
SMITH & SAYRE MFG. COMPANY,

G. G. PORTER, Prest. *245 Broadway, N. Y.* CHAS. W. ISBELL, Sec'y.

Machinery & Apparatus for Gas Works

Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers. Isbell's Patent Self-Sealing Retort Doors.



W. E. Tanner, Pres., W. R. Trigg, V.-Pres., A. Delaney, Supt.

Tanner & Delaney Engine Co.

RICHMOND, VA.

Gas Apparatus,

INCLUDING

Condensers of various styles, Scrubbers, Holders, Purifiers, Castings for Retort Houses, Etc.

ALSO STEAM ENGINES AND BOILERS.

Plans, Specifications and Estimates Furnished.

SOUTHWARK FOUNDRY AND MACHINE COMPANY,

Successors to MERRICK & SONS. Established in 1836.

No. 430 Washington Avenue, Philadelphia, Pa.

MANUFACTURERS OF

Single and Telescopic Gasholders,

BENCH CASTINGS,

Washers, Scrubbers, Condensers, Purifiers,

And all apparatus necessary for the construction of improved new gas works and in the extension of established works. Also manufacturers of

Gas Engines, and of all descriptions of Steam and Hydraulic Machinery, and of Boiler and Tank Work.

Plans, specifications, and estimates furnished promptly on application.

MORRIS, TASKER & CO.,

Limited,

Builders of Gas Works,

PHILADELPHIA, PA.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N. 8th Street, Phila., Pa.

WM. HENRY WHITE,

Consulting & Constructing

Gas Engineer & Contractor.

ESTIMATES, PLANS, AND SPECIFICATIONS FURNISHED FOR NEW WORKS OR EXTENSIONS OF EXISTING WORKS.

32 Pine St., New York City.

Correspondence solicited.

KERR MURRAY MFG. CO.,

MANUFACTURERS OF

Single Lift and Telescopic

GASHOLDERS.

Built, 1884:

Altoona, Pa	Capacity,	160,000 cubic feet.
Pittsburgh, Pa	"	250,000 "
" "	"	220,000 "
Bellaire, Ohio	"	50,000 "
Youngstown, Ohio	"	60,000 "
Canton, "	"	60,000 "
Akron, "	"	80,000 "
Xenia, "	"	10,000 "
Adrian, Mich	"	65,000 "
Ypsilanti, Mich	"	25,000 "
Muskegon, "	"	70,000 "
South Bend, Ind	"	70,000 "
Anderson, "	"	20,000 "
Plainfield, "	"	10,000 "
Springfield, Illinois	"	100,000 "
Evanston, "	"	50,000 "
Freeport, "	"	35,000 "
Elgin, "	"	60,000 "
Sheboygan Wis	"	20,000 "
Key West Fla	"	10,000 "

Plans and estimates furnished for the erection of new and the rebuilding of old works. Address

Kerr Murray Mfg. Co.,

FORT WAYNE, IND.

JAMES R. FLOYD,

(SUCCESSOR TO HERRING & FLOYD)

Oregon Iron Works,

531 to 543 West 20th St., N. Y.

Practical Builders of Gas Works,

MANUFACTURERS OF

ALL KINDS OF CASTINGS
AND
APPARATUS FOR GAS-WORKS.

BENCH CASTINGS
from benches of one to six Retorts each.
WASHERS: MULTITUBLAR AND AIR CONDENSERS; CONDENSERS; SCRUBBERS
wet and dry), and
EXHAUSTERS
for relieving Retorts from pressure.
BENDS and BRANCHES
of all sizes and description.
FLOYD'S PATENT
MALLEABLE RETORT LID.
PATENT
SELF-SEALING RETORT LIDS.
FARMER'S
PATENT BYE-PASS DIP-PIPE.
SABBATON'S PATENT
FURNACE DOOR AND FRAME.
BUTLER'S
COKE SCREENING SHOVELS.

GAS GOVERNORS,

and everything connected with well regulated Gas Works at low price, and in complete order.

SELLER'S CEMENT

for stopping leaks in Retorts.

N. B.—**STOP VALVES** from three to thirty inches—at very low prices.
Plans, Specifications, and Estimates furnished.

CONTINENTAL WORKS.

GASHOLDERS OF ANY MAGNITUDE.

T. F. ROWLAND, Proprietor.
GREENPOINT, BROOKLYN, N. Y.
ENGINEER AND MANUFACTURER OF
GAS-HOLDERS.
CONDENSERS, SCRUBBERS, VALVES, PURIFIERS, RETORTS, and HYDRAULIC MAINS,
and all other articles connected with the Manufacture and Distribution of Gas. Plans and Specifications prepared and Proposals given for the necessary Plant for Lighting Cities, Towns, Mansions, and Manufactories.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Pres. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.

STACEY MFG. CO.,

MANUFACTURERS OF

Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works. Rolling Mill Machinery and Heavy Castings a Specialty.

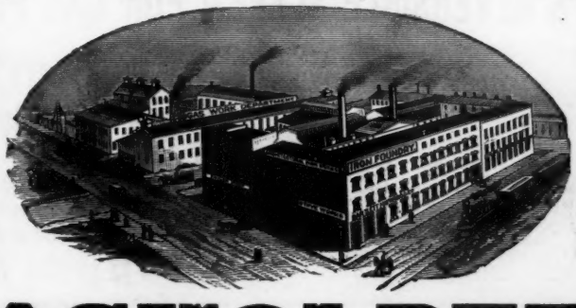
Foundry: 33, 35, 37 & 39 Mill Street. **Wrought Iron Works:** 16, 18, 20, 22, 24 & 26 Ramsey Street.

Cincinnati, Ohio.

BARTLETT, HAYWARD & CO.,

Office, 24 Light. **BALTIMORE, MD.** Works, Pratt &

PURIFIERS. Roofs. Bench Castings.



SCRUBBERS. BOILERS. CONDENSERS.

GASHOLDERS.

CONSTRUCTING ENGINEERS AND BUILDERS OF GAS WORKS.

1842. **DEILY & FOWLER,** 1885.

Laurel Iron Works.

Address, No. 39 Laurel Street, Philadelphia, Pa.

MANUFACTURERS OF

GASHOLDERS,

Single or Telescopic, with Cast or Wrought Iron Guide Frames.

Holders Built Since 1880:

Mount Joy, Pa.
Rockaway B'ch, N.Y. (2)
Zanesville, O. (3d.)
Lancaster, O.
Blackwell's Island N. Y.
Waltham, Mass., (1st.)
Dorchester, Mass.
Wheeling, West Va.
Lansing, Mich.
Flint, Mich.
Galveston, Texas (1st.)
Milton, Pa.
Scranton, Pa.
West Point, N. Y.
Fitchburgh, Mass.
New London, Conn.
Derby, Conn.
Bridgeport, Conn.
Allegheny, Pa. (1st.)
St. Hyacinth, Can.
Norwalk, O.
Brattleboro, Vt.
Waltham, Mass (3d.)
West Chester, Pa.
Baltimore, Md.
Hollidaysburg, Pa.
Galveston, Texas (2d.)
Marlboro, Mass.
Denver, Col.
Chicago, Ill. (West Side).
Pittsburgh, Pa. (S. Side).
Pawtucket, R. I.
Brookline, Mass.
Sherbrooke, Can.
Burlington, N. J. (3d.)
Bridgeton, N. J.
Bay City, Mich.
Erie, Pa.
Jackson, Mich.
Kalamazoo, Mich. (3d.)
Glen Island, N. Y.
Warren, Ohio.
Bath, N. Y.
Lynn, Mass.
New Bedford, Mass.
Waterbury, Conn.
Deseronto, Can.
Hoosic Falls, N. Y. (2d.)
Bethlehem, Pa.
Atlanta, Ga. (1st.)
Savannah, Ga.
Montgomery, Ala
Newport, R. I.
Portland, Oregon.
Allegheny, Pa. (3d.)
Atlanta, Ga. (2d.)
N.Y.City (Central Ga.)
Lynchburg, Va. (2d.)
Saylesville, R. I.
Rondout, N. Y.
Atlantic City, N. J.
Augusta, Ga.
Waltham, Mass. (2)

GAS COALS. GAS COALS. GAS COALS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

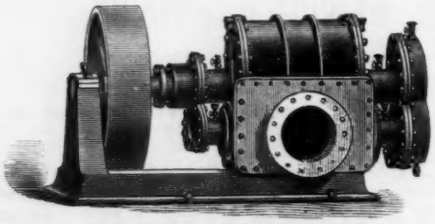
General Sales Agents for

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

The Coal from the Ocean Mine (recently operated by Messrs. W. L. Scott & Co., of Erie, Pa.,) is now used by all the leading Gas Companies in the United States from Maine to Texas, and is recognized as *the only reliable Youghiogheny Gas Coal.* (See Map on p. 87 of this Journal, Feb. 16, 1885.)

P. O. Box 3695, New York. **PERKINS & CO., 228 and 229 N. Y. Produce Exchange** BEAVER STREET ENTRANCE.



Gas Exhauster Driven by Belt.

The Wilbraham Gas Exhauster,

"BAKER SYSTEM,"

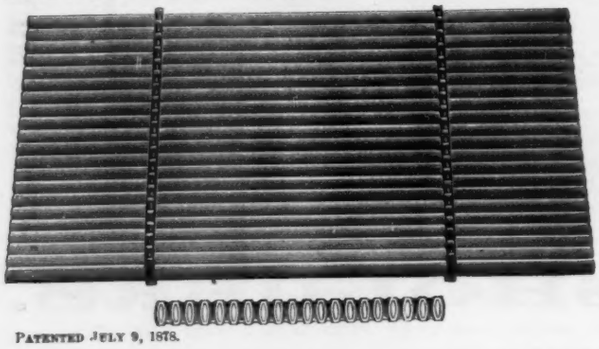
WITH ENGINE ATTACHED, ON SAME BED PLATE OR WITHOUT.

Best, Cheapest and Most Durable Exhauster known.

WILBRAHAM BROS.,

No. 2320 Frankford Avenue, Philadelphia, Pa.

CHURCH'S REVERSIBLE SCREEN FOR GAS PURIFIERS



PATENTED JULY 9, 1878.

Very Durable

Easily Repaired.

Oval Slats, with Malleable Iron Cross Bars.

Apply to

JOHN CABOT,

LAWRENCE, MASS.

References in all parts of the country. Send for circular and list of companies who now have the Screen in use.

GAS CO. OFFICERS, READ AND REFLECT.

It will "Pay the Piper,"

If he aims to pipe well for STEAM, WATER, GAS, ACIDS, OILS, AMMONIA, &c., to examine this UNION, which requires no packing, but is always ready for instant use. When you next order Fittings of any Dealer, ask for a sample American Union to come with them, and it will tell you the whole story, or we will, if you write us for particulars.

PANCOAST & MAULE,

PHILADELPHIA, PA.

Pipe Coverings.

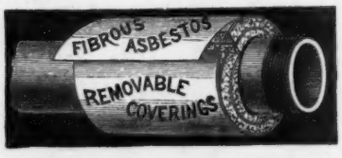
Fireproof, Non-Conducting Coverings for

STEAM PIPES, BOILERS,

And all Hot Surfaces.

Made in sections three feet long. Easy to apply; light and cheap.

Asbestos Materials, Fibre, Braided Packing, and Cement.



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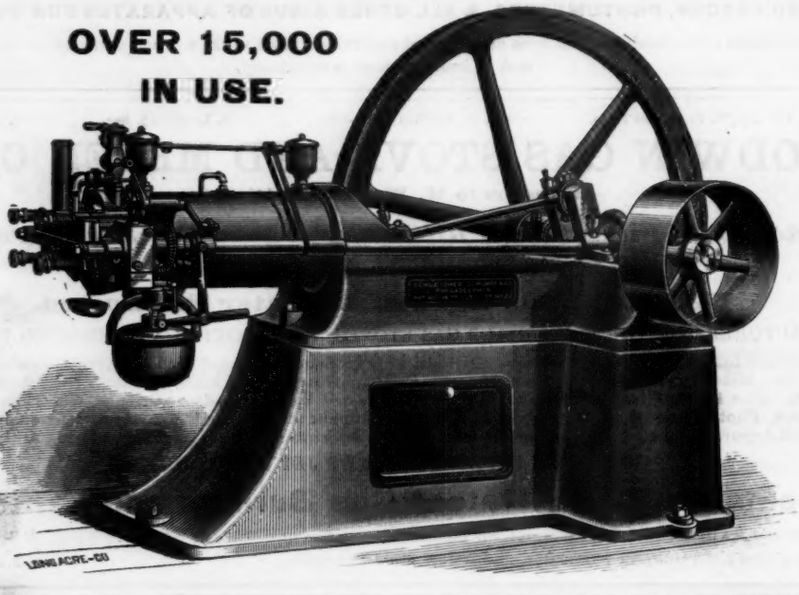

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